BMI, BP, Visual Acuity and Hearing Status of Special Olympics Athletes in Sarawak

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ABSTRACT

Introduction	Special Olympics (SO) Inc. is an organization for people with intellectual disability (ID) to actively engaging in Olympic-type sport and participating in competition. Special Olympic Inc. provides Healthy Athletes Programme (HAP®) in screening and providing health education to Special Olympic Athletes.
Objective	To study the body mass index (BMI), blood pressure (BP), visual acuity and hearing status of children and young adult with ID in Special Olympics Sarawak.
Methods	Health data were collected by trained health professionals under HAP® held in conjunction with Special Olympics Sarawak State Games on 17th and 18th April 2010 in Sibu. Health data collected were athletes' weight, BMI, BP, ear canal screen and hearing status (oto-acoustic emission, pure tone audiometry), as well as eye health and visual acuity, using guidelines set by HAP®.
Results	195 athletes attended the State Games in 2010 of which 138 were screened. Significant number of athletes was considered overweight / obese (31.5% for children and 36.9% for adult). More than 20% of the adult athletes were hypertensive or at risk of hypertension. Sixteen percent of the adult athletes had hearing loss. More than half of the adult and children athletes never had eye checks, and a significant numbers of them had abnormal eye tests results.
Conclusions	Health screening conducted during the HAP® is a useful screening program in this population. Health data collected can bring awareness to athletes and their family, and corrective measures in hearing and visual impairment can be taken immediately.
Keywords	Intellectual disability - Special Olympics - health screening - body mass index - BP
Abbreviations	SO = Special Olympics, HAP = Healthy Athletes Program, BMI = body mass index, BP = BP, PTA = pure tone audiometry, OAE = oto-acoustic emission, ID = intellectual disability, SD = standard deviation

INTRODUCTION

Special Olympics (SO) Inc. is an international sports organization for people with ID to actively engaging in Olympic-type sport and participating in competition. The organization promotes understanding, acceptance and inclusion of people with ID in order to empower them to become physically fit, productive and respected members of the society through sport training and competition [1]. Recognizing that children and young adult with ID have different health care needs, and they are often not accessible to standard healthcare available in the community for various reasons, a global Healthy Athletes Programme® (HAP®) by the SO Inc. was launched in 1997 to provide free health screening to athletes on vision, hearing, oral health, lifestyle, general fitness, podiatry and physical fitness by partnering with the community and health professionals [1].

Taking the opportunity when SO athletes in Sarawak gathered for their State Games on 17th and 18th of April 2010, SO Sarawak organized HAP® for the athletes and run concurrently with the sports games in the stadium. All the authors were either involved in training the health volunteers or directly helping and supervising in running the HAP®. Health data were collected and health screening as well as education was conducted according to the standard set by SO Inc. and HAP® [1].

OBJECTIVES

To study the body mass index (BMI), blood pressure (BP), visual acuity and hearing status of children and young adult with ID in Special Olympics Sarawak.

DEFINITION AND METHODS

Health data collected by trained health professionals during HAP® held in conjunction with SO Sarawak State Games on 17th and 18th April 2010 in Sibu were retrieved retrospectively. Health data relevant to the athletes' BMI (weight and height), BP, ear canal examination, hearing status (otoacoustic emission (OAE), pure tone audiometry (PTA)), as well as eye health and visual screens (visual acuity, colour vision and stereopsis) were analysed. Approval was obtained from SO Inc. in Washington and SO Sarawak for the use of these health data.

Children were defined as those below 18 years of age, whereas those 18 years and above were considered as adult. BMI is an index of fatness and obesity and used as a guideline for defining whether a person is overweight and an indicator of obesity, and it is a measurement of the relative percentage of muscle mass in kilogram and body height in meters square. For adult, overweight and obesity based on the BMI was defined using the standard set by the Centres of Disease Control and Prevention (CDC) [2]. For the children and teens, BMI ranges for children and teens were defined so that they took into account normal differences in body fat between boys and girls and differences in body fat at various ages. BMI-for-age growth charts for girls and boys from CDC were used in this study [2].

In this study, BP was measured using the manual sphygmomanometer. For children athletes, BP Tables for children and adolescents according to height, gender and age from National Heart, Lung and Blood Institute were used [3]. BP above 95th percentile was considered hypertensive. For adult, the classification of BP for adults age 18 years and older by American Heart Association was used in this study [4]. Visual acuity was tested using Lea Symbols developed by Lea Hyvarinen. Colour vision was tested using Testing Made Easy by T.L. Waggoner, a type of pseudo-isochromatic chart design for children, which screened mainly for red and green colour deficiency. For stereopsis, Random Dot E test was used, and non-verbal athletes were excluded. Hearing screening was performed using Biological Audx and GSI for the OAE and Inter Acoustic AS216 for PTA. Standard protocols by SO Inc. and HAP® were practiced during these visual and auditory tests [1].

DATA ANALYSIS

The data was analysed using Microsoft Excel 2010. Statistical analysis involved descriptive analyses of the athletes' demographics and health data. Further statistical analysis was conducted using χ^2 tests in qualitative data. T-tests were used to analyze quantitative data. A p value of equal and less than 0.05 was considered statistically significant.

RESULTS

A total of 195 athletes took part in the SO Sarawak State Games in 2010, of which 70.8% (n = 138) of them underwent HAP® health screening and education. There were 11 divisions in Sarawak, and only 2 divisions (i.e. Kapit and Limbang) were not represented in the State Games (Betong and Sri Aman combined their team). There were 73 children (mean age of 14.6 ± 2.0 years) and 65 adult (mean age of 23.7 ± 4.8) athletes participated in the HAP® (Table 2).

Table 1 Number of Athletes Attended SO State Games 2010 and HAP®

Divisions	Total numbers of athletes in the States Games	Numbers of athletes attended HAP®
Sibu	79	54 (39.1%)
Kuching	49	33 (23.9%)
Miri	25	24 (17.4%)
Bintulu	18	12 (8.7%)
Samarahan	10	4 (2.9%)
Betong & Sri Aman	5	3 (2.2%)
Sarikei	5	4 (2.9%)
Mukah	4	4 (2.9%)
Total	**195**	**138 (70.8%)**

Table 2 Gender and Age Detail of Sarawak Special Olympics Athletes Attended HAP®

		Male	Female	Total
Children (<18 years)	Numbers	50	23	73
	Mean age (SD) in years	14.4 ± 2.0	14.9 ± 1.9	14.6 ± 2.0
Adult (18 years and above)	Numbers	46	19	65
	Mean age (SD) in years	23.6 ± 5.1	23.9 ± 4.2	23.7 ± 4.8

Table 3 summarised the BMI of children by using BMI-for-age growth percentile and CDC classification. Nine children (12.3%) were considered under-weight (< 5th percentile), whereas 56.2% (n = 41) of the children had normal BMI (5th – 85th percentile). Twenty-three children athletes (31.5%) were considered either over-weight or obese (>85th percentile). There was no significant difference between the gender and CDC classification for BMI in children athletes (p = 0.12). Table 4 provided the detail of BMI in adult athletes. Eight adult athletes (12.3%) were considered underweight. Thirty-three (50.8%) adult athletes had normal BMI (18.5 - <25 kg/m^2) and 36.9% (n = 24) of the adult athletes were noted to be overweight or obese based (BMI $\geq$25 kg/m^2). There was no significant difference between the gender and CDC classification for BMI in adult athletes (p = 0.16).

Table 3 BMI Percentile and CDC Classification for Sarawak Special Olympics Children Athletes

BMI Percentile	CDC Classification for BMI	Male (n = 50)	Female (n = 23)	Total (n = 73)	p-value
< 5th	Under-weight	7 (14%)	2 (8.7%)	9 (12.3%)	
5th - <50th	Normal	13 (26%)	10 (43.5%)	23 (31.5%)	
50th - <85th	Normal	16 (32%)	2 (8.7%)	18 (24.7%)	0.12
85th - <95th	Over-weight	2 (4%)	3 (13.0%)	5 (6.8%)	
$\geq$ 95th	Obese	12 (24%)	6 (26.1%)	18 (24.7%)	

Table 4 BMI Percentile and CDC Classification for Sarawak Special Olympics Adult Athletes

BMI (kg/m^2)	CDC Classification for BMI	Male (n = 46)	Female (n = 19)	Total (n = 65)	p-value
< 18.5	Underweight	6 (13.0%)	2 (10.5%)	8 (12.3%)	
18.5 - <23	Normal	19 (41.3%)	7 (36.8%)	26 (40.0%)	
23- <25	Normal	6 (13.0%)	1 (5.3%)	7 (10.8%)	0.61
25 - <30	Over-weight	7 (15.2%)	6 (31.6%)	13 (20.0%)	
> 30	Obese	8 (17.4%)	3 (15.8%)	11 (16.9%)	

For BP, there were 2 children whose diastolic BP and systolic BP were recorded above the 95th percentile respectively (Table 5). There were no significant differences between the gender and systolic BP (p = 0.13), as well as diastolic BP (p = 0.14) for the children athletes. In adult athletes, the mean systolic and diastolic BPs were 114 ± 16 mmHg and 70 ± 11 mmHg respectively (Table 6). However, 13 adult athletes (22.8%) were noted to have pre-hypertensive systolic BP while another 8 athletes (14.0%) had either stage I or II hypertension based on the systolic BP. For diastolic

BP, 5 athletes (8.8%) had pre-hypertension, while another 8 athletes (14.0%) had either stage I or II hypertension. There were no significant differences between the gender and systolic BP (p = 0.77) and diastolic BP (p = 0.90) in adult athletes.

Table 5 Percentile Rank of BP in Sarawak Special Olympics Children Athletes

Percentile Rank of BP	Male (n = 45)		Female (n = 21)		Total (n = 66)	
	systolic BP	diastolic BP	systolic BP	diastolic BP	systolic BP	diastolic BP
< 50th	24 (53.3%)	24 (53.3%)	7 (33.3%)	11 (52.4%)	31 (47.0%)	35 (53.0%)
50th - < 95th	21 (46.7%)	20 (44.4%)	13 (61.9%)	10 (47.6%)	33 (50.0%)	30 (45.5%)
≥ 95th	0	1 (2.2%)	1 (4.8%)	0	1 (1.5%)	1 (1.5%)

Table 6 Classification and Mean BP in Sarawak Special Olympics Adult Athletes

Classification of BP (mmHg)	Male (n = 41)		Female (n = 16)		Total (n = 57)	
	systolic BP	diastolic BP	systolic BP	diastolic BP	systolic BP	diastolic BP
Mean +/- SD	115 ± 16	71 ± 11	112 ± 18	69 ± 10	114 ± 16	70 ± 11
Normal (<120/80)	25 (61.0%)	31 (75.6%)	11 (68.8%)	13 (81.3%)	36 (63.2%)	44 (77.2%)
Pre-Hypertensive State (120-139 / 80 - 90)	10 (24.4%)	4 (9.8%)	3 (18.8%)	1 (6.3%)	13 (22.8%)	5 (8.8%)
Stage I Hypertension (140-159 / 90-99)	5 (12.2%)	5 (12.2%)	1 (6.3%)	2 (12.5%)	6 (10.5%)	7 (12.3%)
Stage II Hypertension (>160/100)	1 (2.4%)	1 (2.4%)	1 (6.3%)	0	2 (3.5%)	1 (1.8%)

Among 73 children athletes who underwent ear canal examination, 9.6% (n = 7) had either one or both ears partially blocked by wax, and another 6.9% (n = 5) had bilateral blocked ear canals (Table 7). However, in adult athletes 8.2% (n = 61) had either one or both ears blocked partially by wax and 9 adult athletes (14.8%) had bilateral blocked ear canals while another 3.3% (n = 2) had unilateral blocked ear canals. Fifty children (68.5%) and 26 adult (42.6%) athletes passed OAE. However, 14 children (19.2%) and 20 adult (32.8%) athletes failed the OAE in either one or both ears. Nine children and 13 adult athletes did not complete the OAE. Among the 6 children who had failed OAE in both ears, one had failed PTA 2000 Hz and 4000 Hz in both ears. Among the 11 adult athletes who failed OAE in both ears, 6 had failed PTA for both frequencies in both ears, and 1 failed PTA 4000 Hz in both ears (1 refused the PTA). Among the 9 adult athletes who had failed OAE in one ear, 1 also failed PTA in both frequencies in both of his ears. Among the 13 adult athletes who did not undergo OAE, 2 had failed PTA at both frequencies in both ears. In short, 10 out of the 61 adult athletes (16.4%) had failed PTA of either one or both frequencies.

Table 7 Findings of Ear Canal Examination and OAE Results in Athletes of Special Olympics Sarawak

Examination / Test	Findings	Children (n = 73)	Adult (n = 61)
Ear Canal Examination	Clear both ears	61 (83.6%)	42 (68.9%)
	Partial blocked: one or both ears	7 (9.6%)	5 (8.2%)
	Blocked: one ear	0	2 (3.3%)
	Blocked: both ears	5 (6.8%)	9 (14.8%)
	Did not check	0	3 (4.9%)
Oto-acoustic Emission (OAE)	Pass both ears	50 (68.5%)	26 (42.6%)
	Fail both ears	6 (8.2%)	11 (18.0%)
	Fail one ear	8 (11.0%)	9 (14.8%)
	Did not do	9 (12.3%)	13 (21.3%)

Fifty percent of the children athletes (n = 37) and 55% of the adult athletes never have eye check before (Table 8). Twenty-four of the 74 children athletes screened (32.4%) had far vision that were worse than 20/40, while 4.2% (n = 3) of those screened (n = 71) for near vision were worse than 20/40 (Table 9). Three children failed the colour vision test (n = 3). Among the 63 children who had the stereopsis tests, 17 (27.0%) failed. For adult athletes, 60.0% (n = 36) of those tested had far vision that were worse than 20/40, and 27.7% (n = 13) had near vision that were worse than 20/40.

One adult athlete failed colour vision test and 44.4% (n = 22) of those tested for stereopsis failed.

Table 8 Timing of Last Eye Check for the Athletes of Special Olympics Sarawak

Duration	Children (n = 74)	Adult (n = 60)
< 1 year ago	11 (14.9%)	7 (11.7%)
1 – <3 years ago	14 (18.9%)	9 (15.0%)
≥ 3 years ago	6 (8.1%)	5 (8.3%)
Never	37 (50.0%)	33 (55.0%)
Unsure	6 (8.1%)	6 (10.0%)

Table 9 Visual Tests Results of the Athletes of Special Olympics Sarawak

	Children		Adult	
	Screened	Worse/Failed	Screened	Worse/Failed
Far Vision (worse than 20/40)	74	24 (32.4%)	60	36 (60.0%)
Near Vision (worse than 20/40)	71	3 (4.2%)	47	13 (27.7%)
Colour Vision (failed if trial >2/9)	71	3 (4.2%)	55	1 (1.8%)
Stereopsis (fail if <5/6 correct)	63	17 (27.0%)	50	22 (44.4%)

DISCUSSION

This study has demonstrated that a significant number of SO athletes, i.e. people with ID were either obese or overweight regardless of age or sex. In addition, a significant number of adult athletes were also noted to have high BP that was considered hypertensive. BMI is just one indicator of potential health risks associated with being overweight or obese, labels for ranges of weight that are greater than what is generally considered healthy for a given height [2]. Systolic BP is also an important predictor of stroke risk and the need to control the systolic BP in the population [5]. This indicates that SO athletes are at risk of heart disease, diabetic, cancer and other chronic diseases that are associated with obesity or overweight and hypertension. The worrying thing is these conditions were not detected earlier and warranted prompt referral during HAP®.

Literature showed that BP awareness, advice received from health care provider and an adoption of healthy behaviors can improve high BP control and reduce the risk for serious sequel such as heart disease and stroke by going on life style change and salt restriction in their diet [6]. These strategies should be as effective for the population with ID. Through HAP®, SO hoped to increase the family awareness, and for the athletes to seriously looking into life style changing and restriction of salt and sugar in diet, besides seeking medical treatment [1].

Hearing screening and ear canal examination are a first step process of identifying an athlete's hearing loss and preventing negative effects from occurring during the sport and social event [1]. In this study, a significant number of athletes had abnormal ear canal examinations and hearing status, especially in the adult population. With HAP®, it was hoped that more athletes will benefit from the screening and referral for corrective measures.

Colour vision, object size, span of recognition and the ability to extract meaning from visual information are important visual skill used in acquiring knowledge, and they influence learning and achievement effectively. Again, in this study, it was demonstrated that a significant number of athletes with ID had abnormal eye examinations and tests results, especially so in the adult population. In addition, a significant numbers of them had never had eye check by professionals despite the risks. With HAP®, it was hoped that more athletes will benefit from the screening and referral for corrective measures.

Clinicians who manage children and adult with ID need to be aware of associated risk that this special population have, and perform surveillance during follow up. With healthier and fitter body, as well as corrected and good eye sight and hearing, a Special Olympics athlete will then perform better in the sport field and day-to-day life.

CONCLUSION

Health screening conducted during the HAP® is a useful screening program for population with ID. Significant numbers of athletes with ID were overweight or obese and hypertension, and at risk of cardiovascular and endocrine diseases. In addition, significant numbers of these athletes did not have normal hearing and vision. Health data collected can bring awareness to athletes and their family, and corrective measures in hearing and visual impairment can be taken immediately.

LIMITATION

This study was done only to the selected population of athletes that took part in the Special Olympic Games and not all Games athletes were included in the screening. In addition, we acknowledge that not all athletes completed the whole screening process available during the HAP®.

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