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Notes

Physical Fitness of Thai Children and Their Environment

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Abstract

Physique, physical functions and motor fitness abilities were measured at four elementary schools in two Thailand cities in 1980. Children from four schools in the two cities were sampled.

Children of a model school (SC) in Bangkok were found to have larger physiques on the average than those of the other three; SS, MC and RC. Children of a public school (SS) are shorter and lighter than the others on the average. Children of the model MC and RC schools in Chiang Mai have better motor fitness on the average than those of the two schools in Bangkok.

Bangkok is a big city, where such factors as heavy traffic, lack of playgrounds and the tropical climate, hamper vigorous activity. Families of SC school children are of higher socio-economic status in Bangkok. These environmental factors may play a part in the physical growth of children. The natural environment, abundant playgrounds and milder climate of Chiang Mai may be favourable for the development of motor fitness of children.

Results of the study in Thailand have something in common with those in Japan. Differences in growth and development of children were found, and differences in some environmental factors are recognized between the two regions.

Lastly, some differences of physique and physical fitness between Thai and Japanese children were noted.

Introduction

Hereditary and environmental factors affect physical growth and development of children [Tanner 1970: Ch.VI]. Various natural and social factors are among the environmental factors. Since children are affected by a complex mixture of these factors, it is difficult to determine the influence of a single factor on human growth. Children in some regions exhibit different phases of development when compared with those of the same age in other regions. These differences urge a study of environmental factors affecting growth and development.

Average physiques of children of the same age are not always the same statistically in all regions of Japan [Japan, Ministry of Education 1979: 218–247]. The same kind of results are found in physical fitness. According to the statistical findings of a previous study [Yagi *et al.* 1976: 219–230], children in central cities are bigger and mature at a younger age on the average than those in

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remote regions. Environmental factors, such as culture and nature, affecting the growth and development of children are found in characteristics of each region.

To study the growth and development of children in the tropical environment, regional differences and other characteristics of physical fitness of children in Thailand will be discussed in this paper.

Subjects and Methods

The subjects for this study are children in Thailand. The samples for discussion are, for the most part, 5th and 6th grade boys and girls of the following four schools: Suan Sunandha, Satit Chula, Regina Coeli and Mont-fort college elementary schools. The former two schools are located in Bangkok and the latter two in Chiang Mai. Bangkok is the capital of Thailand. Chiang Mai is smaller, but still one of the biggest three in Thailand, and lies in a valley in a mountainuous area about 710 kilometers north of Bangkok, about 300 meters above sea level. SS, which stands for Suan Sunandha, is a public school. Satit Chula (SC) is a branch of Chulalongkorn University. Mont-fort College (MC) is a private school for boys and Regina Coeli (RC) is a private school for girls.

The sampling consisted of all children in a class of each grade of the four schools. The sample sizes totaled about 200 in Bangkok and 110 in Chiang Mai (Table 1). From the viewpoint of ethnic composition, most were Thai and some were Chinese. The ethnic composition in Thailand is as follows: 75% Thai, 14% Chinese and 11% minorities (Malays, northern hill tribes, Khmer and Lao) [TIME 1979: 674].

Some items of physical fitness were measured at the four schools in the first half of February 1980 by the authors, officers and teachers at the respective schools. The measurements included elements of physique (height, leg length, weight, chest girth and skinfold fat), physical function (pulse rate at rest, blood pressure and grip strength), and motor ability (50 meter sprint, standing broad jump and softball throw).

Results and Discussion

1. *Regional Differences of Growth and Development of Thai Children*

Measurements from the four school children are presented in Figs. 1~6 and in Table 4. Significant differences between mean values

Table 1 Sample Size and Average Age

School \ Grade		4th		5th		6th		7th	
		N	Age	N	Age	N	Age	N	Age
Boys	SS	12	9.57	29	10.96	18	11.53		
	SC			29	10.63	32	11.72		
	MC			31	10.61	18	11.54	50	11.50
Girls	SS	10	9.98	21	10.70	17	11.55		
	SC			31	10.62	28	11.49		
	RC			30	10.96	30	11.24		

for each item are presented in Table 2.

The average height and weight of boys and girls in the four schools are shown in Fig. 1 and Fig. 2 respectively. There are two angles of study in comparing of measurements: school differences and regional differences.

SS and SC are located in Bangkok. SS is a public school and SC is an elite university branch school. Parents of SC children are officers and teachers who have high status in society. Physiques, such as height and weight, of SC children, who seem to have been raised in relatively affluent circumstances are bigger on the average than those of the others. These observations concur with the findings of Kawahata *et al.* in Japan in 1965.

MC and RC are both elite private schools in Chiang Mai. Children study English from the first grade at those schools; English study starts in higher grades at public schools. Their parents also seem to have high status in society. SC, MC and RC children have a milk break at school. Some of them wear fashionable watches. From the viewpoint of educational

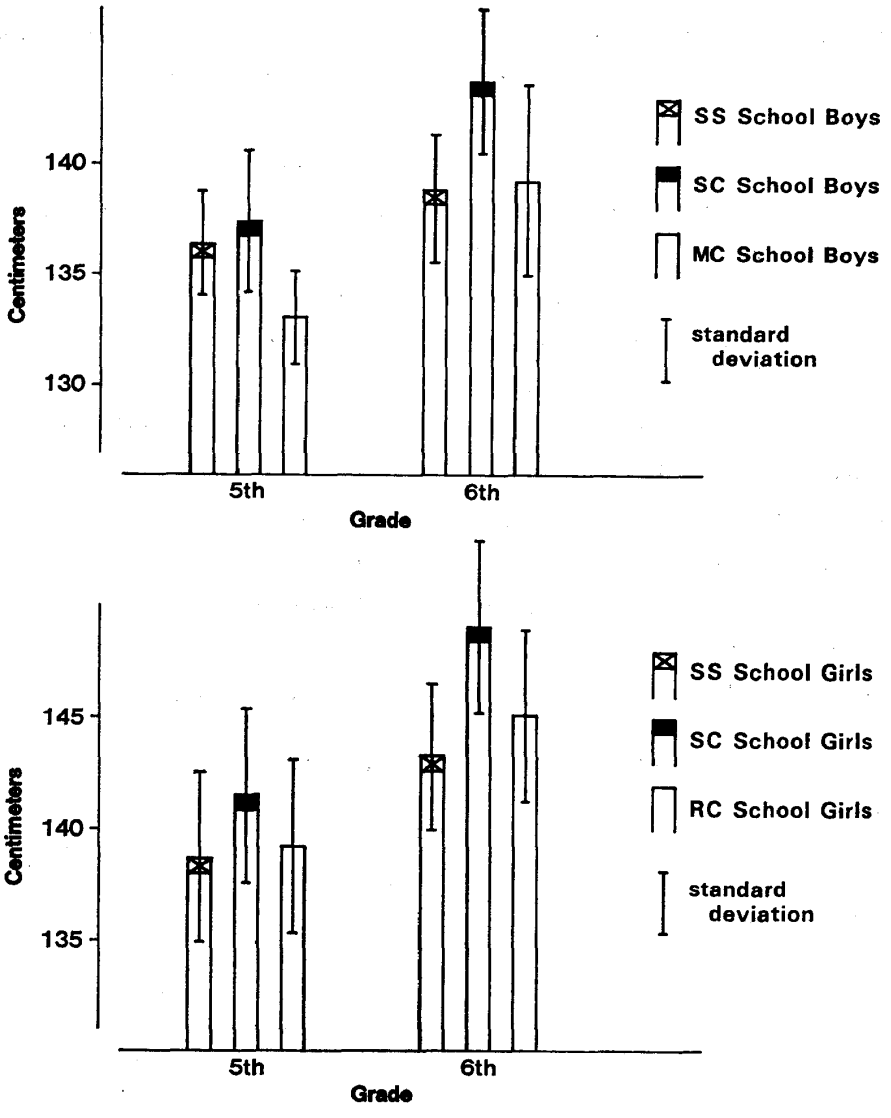

Fig. 1 Average Height

and socio-economic backgrounds, they are comparable to the SC group. The differences in their physiques and physical fitness are believed to result from regional factors.

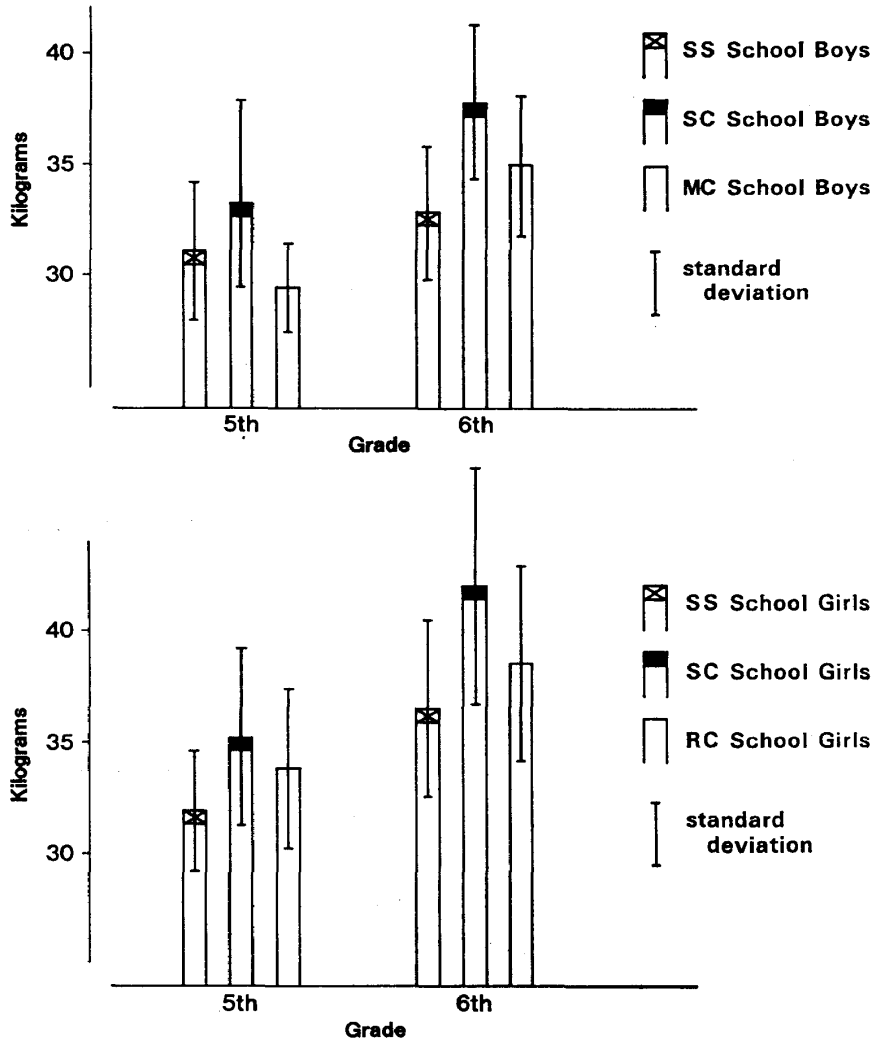

Fig. 2 Average Weight

Table 2 Significant Levels of the Differences of Mean Values of Physical Fitness

	Between SC and MC/RC				Between SC and SS			
	Boys		Girls		Boys		Girls	
Grade	5th	6th	5th	6th	5th	6th	5th	6th
Height	.01	.05	.3	.05		.01	.3	.01
Weight	.05	.3		.3	.3	.01	.1	.1
Skinfold	.05	.05			.001	.001	.001	.01
Grip		.1	.2	.2		.2		.05
Sprint	.1	.01	.01	.01		.01	.05	
Throwing	.1	.05		.01	.01	.3	.3	.1

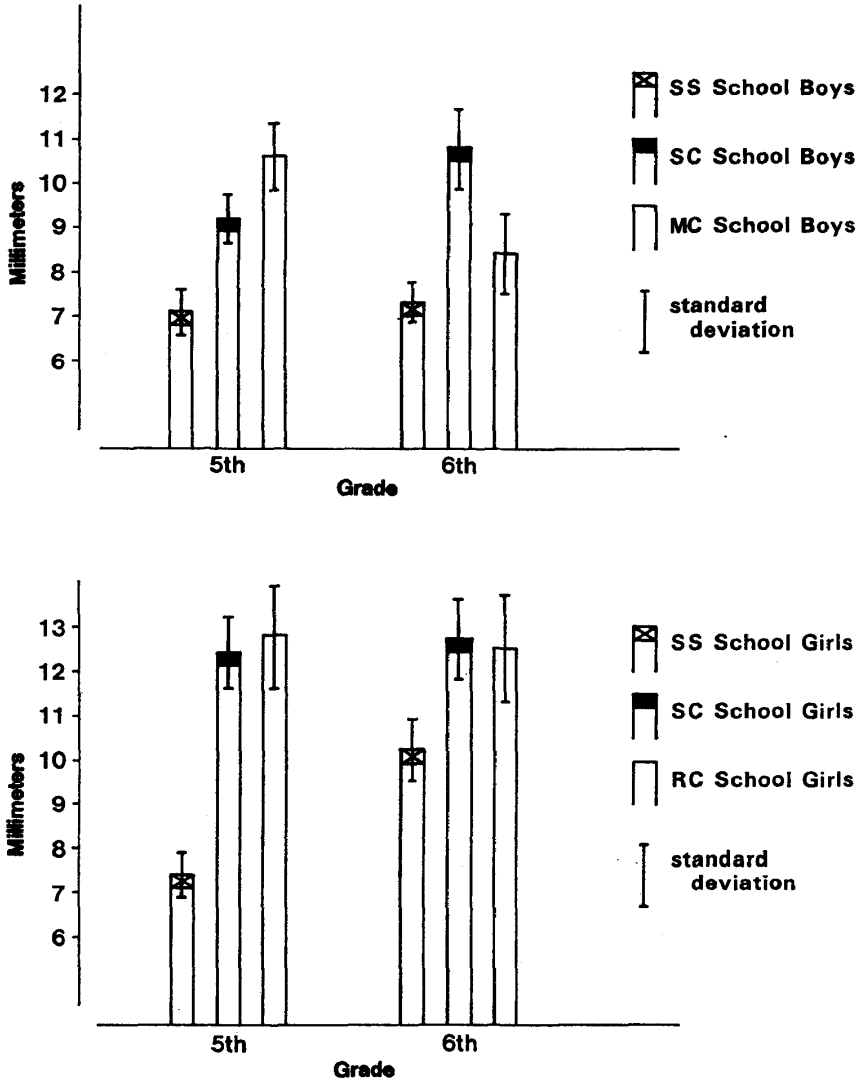

Fig. 3 Skinfold Fat of Upper Arm

Children in Bangkok have bigger physiques than those in Chiang Mai on the average.

There is no difference in skinfold fat between SC and RC schools, but there are some differences between SS and the others (Fig. 3). There are some obese children [Matsuoka 1970: 21–22] in the four schools. There are more obese children in SC, MC and RC than in SS (Table 3). The results imply that nutrition levels for children at elite schools are better than those of public schools. Fig. 3 may also indicate that SC and RC girls are

Table 3 Numbers of Stocky Children Screened by Skinfold and/or Weight and Height

	Boys	Girls
SS	1/59～ 6/59	1/48～ 8/48
SC	3/61～14/61	2/59～17/59
MC	3/99～18/99	
RC		3/60～ 8/60

left: obese by fine screening
Rohrer Index≧170 (height<150) or 160 (height≧150)
right: stocky by rough screening
skinfold > about 13.0 or Rohrer Index > about 140

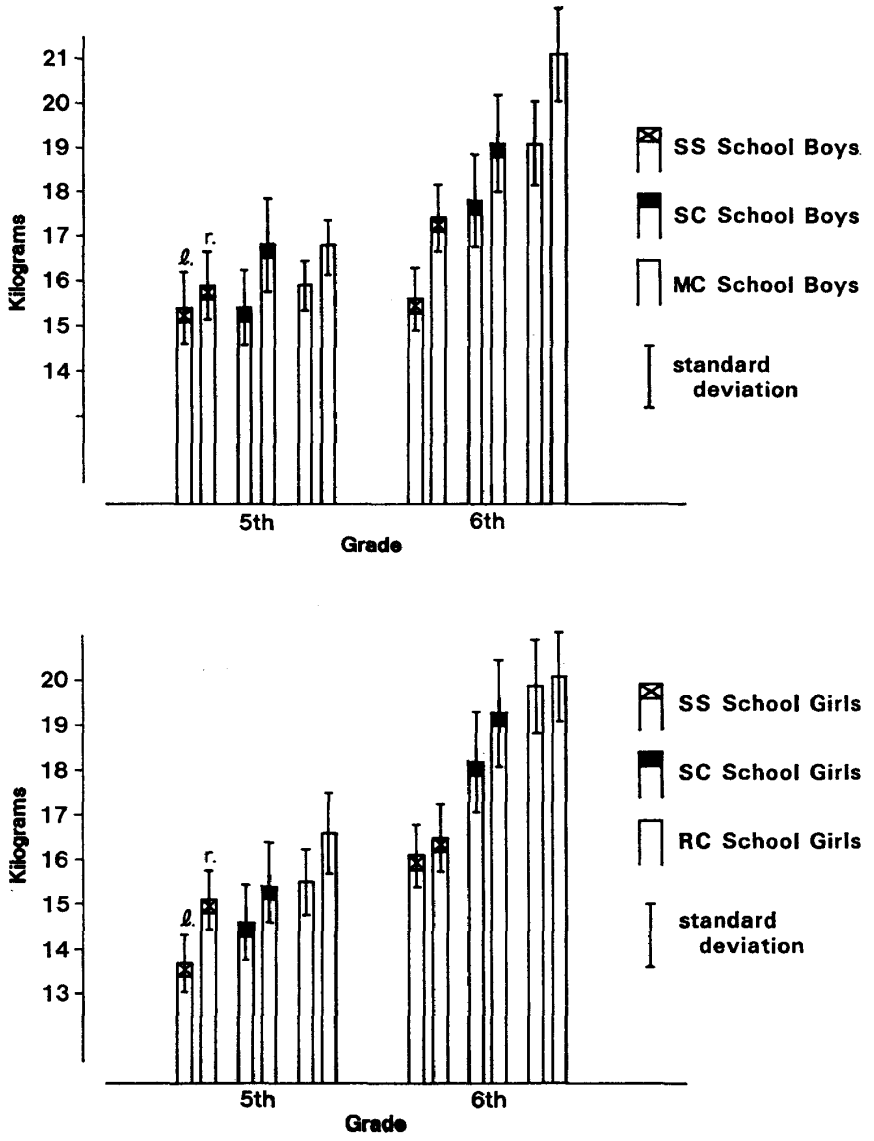

Fig. 4 Grip Strength

more mature than SS girls. Skinfold of SS girls got thicker gradually from the 5th to 6th grades, later than for SC and RC girls.

With regard to the physical functions, results differ depending on physique.

Fig. 4 shows the average grip strength, a typical item of muscle strength. The difference in strength between SS and SC children was less than that of physique, with the exception of the 6th grade girls. Grip strength of MC and RC children is greater than the others.

Figs. 5 and 6 show average motor abilities of children of each of the four schools. Motor abilities, such as the softball throw, of SS, MC and RC children are better than those of SC children. Running abilities of MC and RC children in the 50 meter sprint are better than those of the others.

There is nothing noteworthy the pulse rates among children of the four schools (Table 4), excepting that the obese children had high

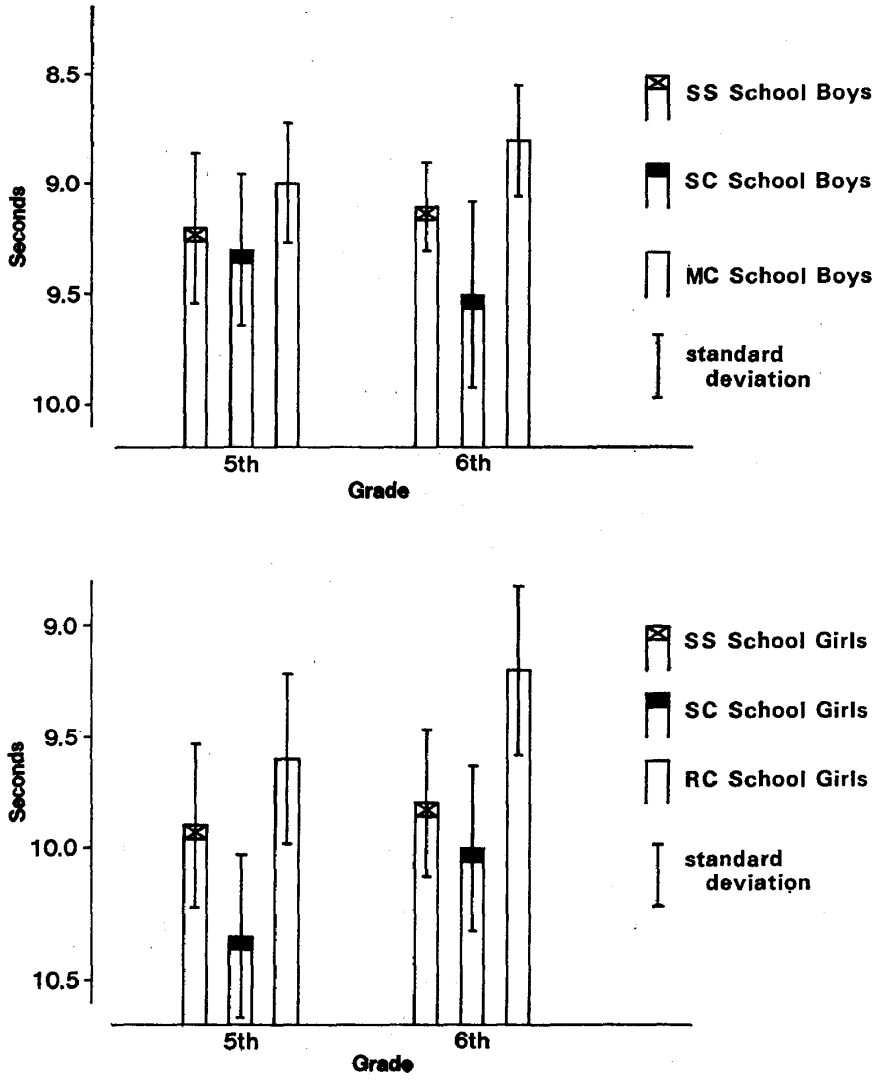

Fig. 5 50 meter Sprint

blood pressure. The significant difference between the mean values of blood pressure of SS and SC boys is $p<0.05$; difference in values between SS girls and SC or RC girls is $p<0.01$.

Leg lengths were proportional to height. Chest girths were proportional to weight, generally.

There were school and regional differences in the physique and physical fitness of children in Thailand as well. Additional information on their educational and living environments follows.

Overpopulation exists in Bangkok where SS and SC schools are located. All public schools are split into morning and afternoon shifts there. Elementary education is compulsory [Ohyama 1973: 150]. Because of heavy traffic and high density, there are not enough places for children to play actively. There are playgrounds at the schools, but the tropical climate seems to prevent children from vigorous activity; they mostly participated in sports programs partaken in the shade of trees. Ohyama reported that the

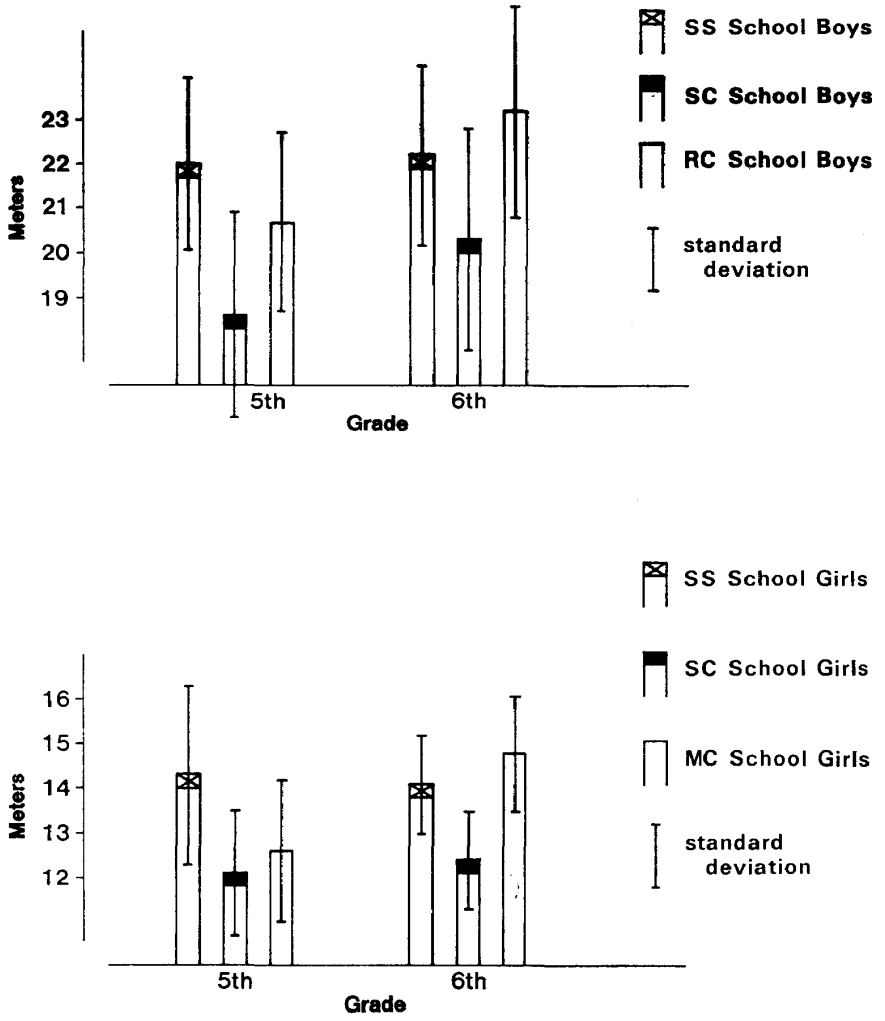

Fig. 6 Softball Throwing Distance

Table 4 Pulse Rate at Rest (Left Half) and Blood Pressure (Right Half) of Boys and Girls of the Four Schools

upper; systolic, lower; diastolic

	Grade / School	5th			6th			5th			6th		
		Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
Boys	SS	84	3.9	29	82	3.9	18	85 51	8.3 9.8	29	86 52	7.2 7.4	18
	SC	86	8.9	28	80	5.9	32				91 58	8.5 6.0	29
	MC	84	6.1	31	88	10.1	17						
Girls	SS	88	8.8	21	90	9.5	17	89 51	12.7 12.5	14	86 49	10.0 7.8	14
	SC	84	5.7	31	90	13.2	28				96 62	11.5 8.7	24
	RC	88	11.6	30	86	8.8	30				105 64	11.4 14.8	30

children usually have physical education class early in the morning [*ibid.*: 161] and that they rarely have a running program at the class in this country [*ibid.*: 152]. Some SS children sell newspapers and other things on the street, while some SC children play table tennis indoors at the school. This shows the contrast of economic status of their families.

The city where MC and RC schools are located lies in a mountainuous area with lower population density than Bangkok. Public schools do not have two shifts. There are playgrounds, fields and hills which enable children to play actively, though they do not always do so. The climate is tropical, but milder than in Bangkok. The annual ranges of monthly average temperature and annual rainfalls (the statistics from 1951–80) are as follows: 21.3°C (Jan.)–29.0°C (Apr.), 1,258 millimeters in Chiang Mai; 25.5°C (Nov.)–30.3°C (Apr.), 1,419 millimeters in Bangkok [Tokyo Tenmondai 1986: 306–309, 350–353]. Physical education in Chiang Mai has been improving. The College of Physical Education was established there nine years ago. It was said that all children had been doing physical exercises for about ten minutes before class every morning at public schools there since two years before this study. They had no understanding of physical education until then.

Even during the measurements of motor abilities, most children wore school uniforms and shoes; some of SS and most of MC and RC children wore sporty clothes and shoes or no shoes when they ran.

These environmental and educational factors are related to the measurements as well as the growth and development of physique and physical fitness of children. Attributes of physique, such as height, weight and skinfold fat, of SC children, who were raised in comparatively affluent circumstances with better nutrition, are larger on the average than those of SS children who were generally raised in a less affluent atmosphere. But the physical function and motor fitness results differed.

There is no enough data to describe the physical activities of children outside of school, but it is probable that they participate in some playful physical activities and help around the house. There were some agile boys who enjoyed jumping onto the rear of a moving car in a hilltribe village in Chiang Mai. Though this activity is not included in the sample group, it is an example of an activity that affects physical fitness attributes such as running ability, strength and the like. The natural environment, such as the climate in Chiang Mai, may be more conducive for physical activities than in Bangkok.

The running and throwing abilities of SS children are better than those of SC children. The lack of vigorous activity and excessweight of SC children resulted in lower sprint times.

Muscle strength is expected to be proportional to body weight to a certain extent, but SS children have more strength for their weight. For example, the weight of 5th grade boys of SC is heavier than that of SS ($p<0.05$), but there is no significant difference in grip strength between the two (Figs. 2 & 4, Table 2).

There are children of same age in various phases of growth and development in Bangkok as seen in the SS and SC children. The same variation may also be found among children in Chiang Mai. However, the noticeable outcome

was that the differences in environmental factors of the two cities provided variances in physique and physical fitness in their respective schools.

The results are similar to those in the subtropics in Japan. The difference in environmental factors, such as nutrition and physical activity, explain the school differences and regional differences of growth and development of physique and physical fitness of the children.

Children in Bangkok have fewer opportunities and less inclination to do vigorous activity because of the tropical climate and setting when compared to MC and RC children in Chiang Mai. Table 5 shows average grip strength and 50-meter sprint measurements of MC, RC and Japanese children. There is no significant difference between the elite private school children in Chiang Mai and the average Japanese children.

The results of tests and measurements do not necessarily show the maximum capacity of physiological function, but do show the maximum of physical activity performance on that occasion which reflects the state of daily physical activity. The results of this study present the average physique, physical function and motor fitness of the sample children on the test day.

It is not certain whether there were any strong racial, hereditary, or other factors among the four samples. However, the data definitely reflect samples of physique and physical fitness of public school in Bangkok and

Table 5 Physical Fitness of Japanese and Thai Children

(1) Grip Strength (average of right & left grips) (kg)

Age	N	Mean	SD	Age	N	Mean	SD	Notes
Japanese boys				girls				
10	955	**18.5**	3.9	10	941	**17.3**	3.9	national average,* 1980
11	995	**21.6**	4.4	11	995	**20.6**	4.6	
MC boys				RC girls				
10.6	31	**16.4**	2.2	10.96	30	**16.1**	2.8	Chiang Mai, Feb. 1980
11.5	68	**20.9**	3.9	11.24	30	**20.5**	4.2	

(2) 50 meter Sprint (sec)

Age	N	Mean	SD	Age	N	Mean	SD	Notes
Japanese boys				girls				
10	960	**9.1**	0.6	10	951	**9.4**	0.7	national average,* 1980
11	1000	**8.8**	0.6	11	1000	**9.0**	0.6	
MC boys				RC girls				
10.6	31	**9.0**	0.5	10.96	30	**9.6**	0.8	Chiang Mai, Feb. 1980
11.5	68	**8.8**	0.6	11.24	30	**9.2**	0.8	

* Japan, Ministry of Education. 1981. *Tairyoku Undonoryoku Chosa Hokokusho* [Report on the Physical Fitness].

elite school children who live in Bangkok and Chiang Mai.

The results of this study are similar to those of the study on children in urban and sub-urban settings in Japan [Yagi 1974]. There is no fundamental difference in the effect of the factor itself between in Thailand in the tropics and Japan in the subtropics. Some big-city environmental factors, for example, promote the physical growth of children; better facilities for physical activity promote motor fitness development in both areas. Moreover, differences in some factors between two areas may also produce differences in growth and development of the children in the two areas.

An additional purpose of this study was to compare the physique and the yearly changes in physiques in Thai and Japanese children.

2. *The Comparison of Height and Weight between Thai and Japanese Children*

Average heights and weights of Japanese 5th and 6th grade boys and girls are presented in the upper half of Table 6; measurements were taken by the School Health Statistics of the Ministry of Education [1979]. The lower half of Table 6 shows the average heights and weights of 5th and 6th grade boys and girls of SS (Suan Sunandha) School in Thailand.

The figures in this table do not provide a perfect comparison: physical measurements

Table 6 Yearly Changes in Height and Weight of Japanese and Thai Children

(1) Japanese

	Boys			Girls			Ages (National Avg.)
	1971	1973	1978	1971	1973	1978	
5th grade							10.5
Height	135.5	136.0	137.1	136.4	137.1	138.2	
Weight	30.8	31.4	32.0	31.1	31.9	32.4	
6th grade							11.5
Height	140.8	141.5	142.4	143.4	143.7	144.4	
Weight	34.2	35.0	35.6	36.0	36.6	36.8	

(2) Thai

	Boys		Girls		Ages (Suan Sunandha)			
					Boys		Girls	
	Aug. 1973	Feb. 1980	Aug. 1973	Feb. 1980	'73	'80	'73	'80
5th grade					10.5	10.96	10.4	10.7
Height	135.6	136.4	133.2	138.6				
Weight	29.2	31.1	29.4	31.9				
Number	(20)	(28)	(20)	(21)				
6th grade					11.3	11.53	11.3	11.55
Height	136.4	138.8	142.1	143.3				
Weight	29.3	32.8	34.4	36.5				
Number	(20)	(16)	(20)	(17)				

were taken at the beginning of the school year in Japan, and two to eight months after the beginning of school year in Thailand. Children at those ages can have remarkable growth in a period of a few months. Nevertheless, the average physique of Japanese children seems to be larger than those of Thai children. These Thai samples are taken from a public school in the capital, and their physique may be above average in the country. The Japanese figures are national averages. Therefore, it is assumed that Japanese children are generally greater in physique at the same ages than Thai children.

3. Average Yearly Changes in Physique at the Same Age

The height and weight of Japanese children have increased year by year [Japan, Ministry of Education 1978: 232–251]. Measurements from this study were compared with a former study taken at SS in 1973 [Matsuura *et al.* 1974] to determine if the same is true in Thailand. The results are in the lower half of Table 6. Because the measurements were not taken in the same month as noted above, it is not necessarily valid to consider the yearly changes simply by comparing these data. However, the average height of 5th grade boys in February 1980 is the same measurement of 6th grade boys in August 1973. This strongly suggests that at present boys are taller than boys of the same age six years ago.

Noteworthy also is that obese children were found in every sample school in the recent study. But the former study [Ohyama 1973: 152] reported that there were no obese children in the schools (including SS) in Bangkok in 1973. This also indicates another phase of change in the population. Yearly increases in physical size, such as height and weight, is recognized in Thailand. Environmental conditions for child growth have improved.

Conclusions

There are school and regional differences in physique and physical fitness of children in Thailand. There are also some different environmental factors. Among the factors, nutrition, physical activity, education, living conditions, finances, etc. were discussed. These factors act correlatively and promote the growth and development of physique and physical fitness of children, and some differences in quantity and quality of these factors produce personal, group or regional differences.

There are other children who have other types and degrees of physical fitness in the tropics, even in Thailand. This study presents samples and shows characteristics of physical fitness of children of four schools in two cities in Thailand. Though it is difficult to isolate the effect of a single factor, it is considered that the climate is one of the key factors in the tropical environment. The climate of Bangkok differs from Chiang Mai. The climate of Thailand differs from Japan. Some conditions brought about by the climate may produce differences of physical fitness between the two regions or the two countries. If there are racial differences, some depend on climatic and environmental differences including nutrition, though the climate has little direct effect as Tanner stated [1970: 101–102].

Moreover, there is a variable social factor in the city which, for example, produces

obese or slim bodies with the times or the fashion. This phenomenon is observed both in Thailand and Japan. Secular trends in physique are also recognized in Thailand.

Physical fitness is developed fundamentally by such factors as nutrition and physical activity, even in the tropics. Further, the climate is a main factor for characterizing physical fitness of children in the tropics and phenomena concerning social factors, such as the secular trend in physique, is common to both Japan and Thailand.

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References

Japan, Ministry of Education. 1978. *Gakko Hoken Tokei Chosa Hokokusho* [Report on School Health Statistics].

————. 1979. *Gakko Hoken Tokei Chosa Hokokusho* [Report on School Health Statistics].

Kawahata, A. *et al.* 1965. The Difference in the Growth and Development of School Boys and Girls and Related Factors. *Research Journal of Physical Education* 9(3): 21–27.

Matsuoka, H. 1970. *Himanji* [Obese Child]. 2d ed. Tokyo: Teikoku Chiho Gyosei Gakkai.

Matsuura, Y. *et al.* 1974. A Comparative Study on Physical Fitness of Children of Three Nations; Japanese, Thai and Indonesian. *Tonan Ajia Kenkyu* [Southeast Asian Studies] 12(3): 383–400.

Ohyama, Y. 1973. Tai oyobi Indoneshia niokeru Seishonen no Tairyoku ni kansuru Chosa-hokoku [Report on the Physical Fitness of Youth in Thailand and Indonesia]. *Tonan Ajia Kenkyu* [Southeast Asian Studies] 11(1): 148–163.

Tanner, J.M. 1970. *Education and Physical Growth.* N.Y.: International University Press, INC.

TIME. 1979. *The 1979 Hammond Almanac.* Maplewood: Hammond Almanac, Inc.

Tokyo Tenmondai [Tokyo Astronomical Observatory]. 1986. *Rika Nenpyo* [Chronological Scientific Tables]. Tokyo: Maruzen Co. Ltd.

Yagi, T. 1974. Kyotofu no aru Noson to Tokai no Jido nitsuiteno Taikaku-Tairyoku no Hatsuiku-Hattatsu [The Growth and Development of Physical Fitness of Children in Rural and Urban Districts in Kyoto Prefecture]. *Taiiku no Kagaku* [Journal of Health, Physical Education and Recreation] 24(9): 569–575.

Yagi, T. *et al.* 1976. The Physical Fitness of Boys and Girls in Different Environments. *Sports Sciences Collection* 7. Miami: Symposia Specialists, INC.