

SOME PHYSICAL INDICES IN OUTWARD BOUND SCHOOL CANDIDATES

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SYNOPSIS

Some physical indices of age, height, weight, thickness of subcutaneous tissue, vital capacity, cardiac axis and pulse and blood pressure recovery after exercise are presented of candidates attending the Outward Bound School course in 1970.

The candidates studied were divided into four age groups viz boys <19 years, girls <19 years, men >19 years and ladies >19 years.

On the average heights, the men (67.25 inches) and boys (65.50 inches) are much taller than the ladies and girls (61.50 inches). They also have at least 1-1½ gms. of haemoglobin more than the female candidates.

Although there is some loss of subcutaneous fat after the course in the candidates, there does not seem to be a marked weight loss. Most ladies show loss of subcutaneous fat in the back and triceps areas but a gain in the abdominal subcutaneous fat from 6.55 ± 3.45 mm. to 6.85 ± 2.10 mm.

Cardiac axis show no change and vital capacity (FEV₁ and FVC) are only minimally improved upon after the course. Pulse and blood pressure recovery studies after exercise show a lower commencing pulse rate and blood pressure level, with a smaller rise after exercise and a faster recovery to normal at the end of the Outward Bound School course.

INTRODUCTION

The Outward Bound School at Pulau Ubin has as its motto "To strive, to serve and not to yield". Its basic function may be said to be one of leadership training for its candidates and this the school achieves through the teaching of various activities e.g. jungle survival, water survival, canoeing, cross-country running and various other physical activities. The intention of these instructions conducted over a three week period at the school is that the candidates become aware and are more confident both psychologically and physically of their abilities to achieve more than they thought they were capable of.

The Outward Bound School courses last three weeks and instructions are given to four categories of candidates: boys (age <19 years), girls (age <19 years), ladies (age >19 years) and men (age >19 years). Secondary school pupils make up the candidates of the boys' and girls' groups, whilst the ladies' and men's groups are from the business houses of Singapore, the People's Association, the

teaching profession, and personnel from various Government Ministries. However, some boys and girls are included in the ladies' and men's groups to make up the number in the courses.

STUDY

A survey was commenced in the year 1970 to study some physical indices of the candidates attending the Outward Bound School courses. (Chart A Opportunity is taken to see if a short period of acute training would produce any measurable effects in factors which are known to vary with physical training e.g. body weight, subcutaneous fat, pulse rate, blood pressure, ECG, respiratory volume and physical strength. The four representative groups of boys, girls, men and ladies were studied immediately before attending and on the last day at the school. The indices measured included height, weight, haemoglobin level, thickness of subcutaneous fat at the abdomen, triceps and over the scapula. Of these, the weights and the thickness of the subcutaneous fat were measured before and at the end of the school courses.

In the electrocardiography study, only Lead I and $\bar{a}VF$ were recorded as it was the intention to see if any axis deviation occurred with the physical activity of the course. Pulse rate and blood pressures were recorded at a resting stage, immediately after one minute of a squatting exercise and one minute

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CHART A
OUTWARD BOUND STUDY

No.	Name	Age
1.	Height:	
2.	Weight:	
3.	Hb.:	
4.	Chest Circumference:	
5.	Grip Strength: L (), R ()	
6.	B.P.: (), (), ()	
7.	Pulse Rate: (), (), ()	
8.	E.C.G.: (i) (ii)	
9.	Abd. Circumference:	
10.	Fat Fold: (L) back, (), (R) bicep () abd. ()	
11.	Pulmonary Function: FVC () FEV ₁ ()	

The format used for recording of survey findings of the physical indices measured in the Outward Bound School Candidates.

after rest. This exercise and recordings of pulse and blood pressure were repeated on the last day of the course.

Only in the girls, boys and ladies groups were the Forced Vital Capacity (FVC) and Forced expiratory volume in one second (FEV₁), studied. This was recorded with the use of a McKessons Vitalor Machine, both before and after the course. The better of two readings in the tracings was taken as that representative of the candidates pulmonary function.

RESULTS

The number of candidates, ages, haemoglobin and weight are seen in Table I. The candidates in the ladies' groups were lesser in number and only those who appeared for the first examination were re-studied at the end of it. It can be seen that the age groups of the candidates of the boys and girls and the men and ladies are comparable 15.8 years and 15.9 years and 22.9 years and 22.8 years respectively. The 7 girls included in the ladies group had an average age of 15.8 years, however, the 20 boys (age <19 years) included in the men's group were of an average age of 16.8 years.

The height of the candidates were measured to the nearest quarter inch. The men (67.25 ± 2.25 inches) and boys (65.50 ± 2.50 inches and 65.25 ± 2.25 inches) are on the average taller than the girls (61.50 ± 5.50 inches and 61.50 ± 1.50 inches) and the ladies 61.00 ± 6.00 inches).

The haemoglobin levels were measured by photometry and the lowest levels were obtained in the ladies group (11.6 ± 2.7 g. %). This group consisted of 25 school teachers who were students at the

Teachers Training College. The girls <19 years averaged 12.3 ± 0.9 gm. % and 12.2 ± 0.8 gm. % of haemoglobin and were at least 1 to 1½ gm. % of haemoglobin lower than the boys and the men.

The weights of the candidates were averaged to the nearest quarter pound. There was on the average only a loss of one to two pounds and, in contrast, in the ladies group there was a gain in weight of one pound after the three week course. The men (age >19 years) show an average loss of 2 lbs. from a reading of 130 ± 21.00 lbs. to 128 ± 19.50 lbs.

The thickness of the subcutaneous tissue (Table II) was measured in three areas—over the abdomen, triceps and the back—with skin callipers. This would indicate to some extent the degree of obesity. In general the girls' and ladies' groups have more subcutaneous tissue than the boys and men, although the subcutaneous tissue in the abdominal wall of the men is equal to that of the female candidates. In the ladies' group, there does not seem to be much loss of subcutaneous tissue after the three weeks of training, and in fact there is a gain of subcutaneous fat over the abdominal area—an increase from 6.55 ± 3.45 mm. to 6.85 ± 2.10 mm. In the other groups, most of them show loss of subcutaneous fat in all the areas measured, except for some gain in the triceps area of men over 19 years (4.40 ± 2.85 mm. to 5.40 ± 3.25 mm.) after the course at the school. There seems to be more loss of subcutaneous fat over the abdominal area than in all the other areas.

Cardiac axis (Table III) was measured to the nearest 5° through Lead I and avF of the electrocardiograph before and after the period of training. There is no significant deviation in the cardiac axis because of the training. The cardiac axis of the various group varied between 60°-80°.

Studies of Forced expiratory volume in the second (FEV₁) and Forced Vital Capacity (FVC), Table III, were conducted on only three groups of candidates. It was not studied in the men's group. The results were read from the graphs obtained from a McKessons Vitalor machine—taking the better of two efforts as representative of the candidates pulmonary function. It can be seen that the girls and ladies groups have much smaller FEV₁ and FVC. than the boys. The improvement however in the indices of FEV₁ and FVC are only slight at the end of the course.

The pulse and blood pressure recovery (Table IV) were recorded before and after one minute of an exercise consisting of repeated squatting and rising to the erect posture and again after one minute of rest. In general, it can be seen that the resting pulse rate in all the age groups are slower at the end of the course. There was also a faster recovery to a slower pulse rate after one minute of exercise.

TABLE I

Shows the number of candidates in the age group classifications, the average age, height, in inches, haemoglobin in grammes %, and their weights before and after the Outward Bound School course.

Class	Total No.	Age in Yrs.	Height in ins.		Haemoglobin		Weight Before		Weight After	
			Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Boys	51	15.8	65.50	2.50	13.4	1.6	117.00	17.50	116.00	13.50
Girls	44	15.9	61.50	5.50	12.3	0.9	103.50	10.00	103.50	9.00
Men < 19	20	16.8	65.25	2.25	13.8	0.8	118.00	16.50	117.00	14.75
Men > 19	23	22.8	67.25	2.25	14.9	1.3	130.00	21.00	128.00	19.50
Ladies < 19	7	15.8	61.50	1.50	12.2	0.8	111.00	1.50	108.00	7.00
Ladies > 19	25	22.9	61.00	6.00	11.6	2.7	101.00	4.00	102.00	11.00

TABLE II

Shows the changes measured in the thickness of the subcutaneous tissue measured in millimetres.

Class	Abdomen Before		Abdomen After		Triceps Before		Triceps After		Back Before		Back After	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Boys	4.25	2.15	2.80	1.15	3.00	0.80	2.40	0.50	3.80	1.05	3.35	0.90
Girls	8.15	2.25	7.50	2.15	7.25	1.55	7.50	1.70	6.25	1.45	5.40	1.30
Men < 19	4.85	1.50	4.45	1.98	4.65	1.80	3.95	1.15	4.15	1.15	4.05	0.90
Men > 19	7.50	3.75	5.65	2.35	4.40	2.85	5.40	3.25	5.05	1.60	5.15	1.60
Ladies < 19	7.05	1.70	7.30	1.00	6.85	2.50	6.20	0.90	6.25	2.40	5.00	0.80
Ladies > 19	6.55	3.45	6.85	2.10	5.20	2.50	4.85	1.20	6.25	2.65	6.15	1.70

TABLE III

Shows the changes measured in the Forced Vital Capacity (FVC) and Forced Expiratory Volume in one minute (FEV₁) and the changes in the cardiac axis.

		CARDIAC AXIS				FEV ₁ in L		FEV ₁ in L		FVC in L		FVC in L	
		Before		After		Before		After		Before		After	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Boys		65	20	65	20	2.90	0.53	3.05	0.44	3.30	0.49	3.35	0.58
Girls		60	20	65	20	2.20	0.37	2.30	0.33	2.43	0.38	2.51	0.31
Men	< 19	80	15	80	10	—	—	—	—	—	—	—	—
Men	> 19	60	25	70	15	—	—	—	—	—	—	—	—
Ladies	< 19	70	20	70	20	2.56	0.39	2.52	0.49	2.60	0.37	2.78	0.30
Ladies	> 19	65	15	70	15	2.16	0.31	2.30	0.35	2.36	0.33	2.88	0.58

TABLE IV

Shows the pulse and blood pressure recovery of a one minute exercise before and after attending the course.

Time in Mins.	Before the Course						After the Course					
	Mean ⁰	S.D.	Mean ¹	S.D.	Mean ²	S.D.	Mean ⁰	S.D.	Mean ¹	S.D.	Mean ²	S.D.
Boys												
Pulse	84	17	119	14	100	19	75	11	113	11	88	11
Systolic	115	10	145	20	135	15	110	10	135	15	130	15
Diastolic	70	10	60	10	60	10	70	10	60	15	70	10
Girls												
Pulse	94	16	134	14	118	15	83	12	116	19	95	13
Systolic	120	15	135	10	130	10	110	10	125	15	120	15
Diastolic	75	10	70	10	70	10	70	10	60	10	65	10
Men <19												
Pulse	80	13	128	23	106	21	78	10	110	15	94	17
Systolic	115	15	150	20	140	25	120	15	145	20	135	20
Diastolic	70	10	55	15	65	10	65	10	50	15	60	10
Men >19												
Pulse	85	10	119	14	110	12	76	12	116	15	93	10
Systolic	120	10	150	15	140	15	120	10	150	15	140	15
Diastolic	75	10	60	15	60	15	70	10	50	15	65	15
Ladies <19												
Pulse	107	11	147	13	127	10	87	9	128	20	97	9
Systolic	115	10	135	15	135	15	110	5	120	5	120	10
Diastolic	70	5	65	10	60	10	70	0	60	10	65	5
Ladies >19												
Pulse	89	8	137	19	115	13	89	11	121	8	99	13
Systolic	115	10	130	10	125	10	110	10	130	15	125	15
Diastolic	70	10	65	15	65	10	70	15	60	10	70	10

The blood pressures in all the groups are within the normal range with lower resting systolic and diastolic pressures at the end of the course. The blood pressures show a wider pulse pressure both at the end of the exercise and after one minute of rest before the commencement of the course. However, after the course, the pulse pressures recorded immediately after the exercise and after one minute of rest are smaller at the end of the training at the Outward Bound School. The fluctuation in the pulse pressures parallel the changes of the pulse recovery and show a higher pulse pressure associated with a higher pulse rate before, and a lower pulse pressure and pulse rate after the course at the school.

Physical strength was measured by estimation to grip strength with a dynamometer. The results were very irregular suggesting more the inaccuracy inherent in such a method of measurement than any true change. No conclusion can be drawn and hence the results are excluded.

COMMENTS

This survey reveals some physical indices of a selected group of the youth of Singapore. The average male is taller by 4 inches than the average female. He is also much heavier in weight. As expected, the males have a higher haemoglobin level than the females and this is attributable partly to the effects of menstruation. The working men (age >19 years) are heavies, and have a better haemoglobin level than all as they probably have a better nutrition intake.

In spite of being lighter in weight and smaller in stature, the females have more subcutaneous fat over the abdomen, triceps and back. Only the working class males (age >19 years) have subcutaneous fat around the abdomen comparable to the female groups. The loss of subcutaneous fat seems to occur most in the abdominal area in this group of candidates who show an average loss of two pounds after the course. Although there is some loss of

subcutaneous fat after the course in the candidates, there does not seem to be marked average weight loss. This may be attributable to a gain in protein and muscle bulk to compensate for the loss of the fat.

FEV₁ and FVC only show small increases in volume and are probably contributed in a small way by increased utilization of vital capacity e.g. at cross-country running and other physical activities, and in a greater measure to the familiarity with the use of the McKessons Vitalor machine. Cardiac axis show no change with the three weeks course.

The pulse and blood pressure reading before and after the squatting exercise would vary with the physical effort and the motivation of the individual to do the test. Nevertheless, it shows the pulse rate and pulse pressures varying less widely with a similar exercise conducted after the course at the Outward Bound School. This can be due to a combination of better physical fitness with the training at the course, a familiarity with the test, and even a lesser motiva-

tion on the part of the candidate to do the test but the latter two are likely to be of much less significance. These would then contribute to the recording of a slower pulse rate and a lesser pulse pressure difference.

It is quite evident, on seeing the performances of the candidates at the Outward Bound School that it was the individual determination and motivation to achieve success in the various tasks set before them by instructors at the Outward Bound School rather than an improvement of their physique, which carried the individual candidate gallantly through the course.

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