

4224-2

成長と老化, 及び積極的トレーニングとの関連からみた
日本人の Aerobic Work Capacity.

{ 附表 } { 四 } 編.

小林 寛道

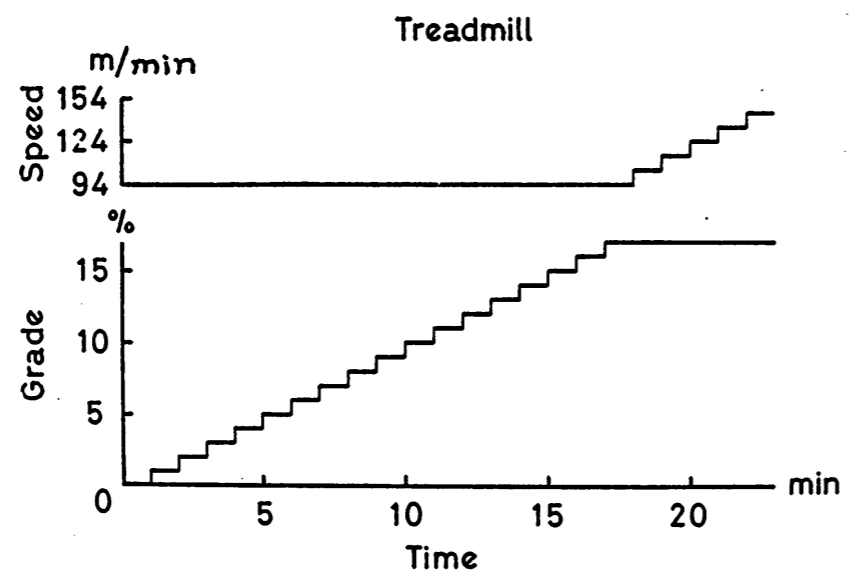


図1. トレッドミル歩行法の負荷設定.

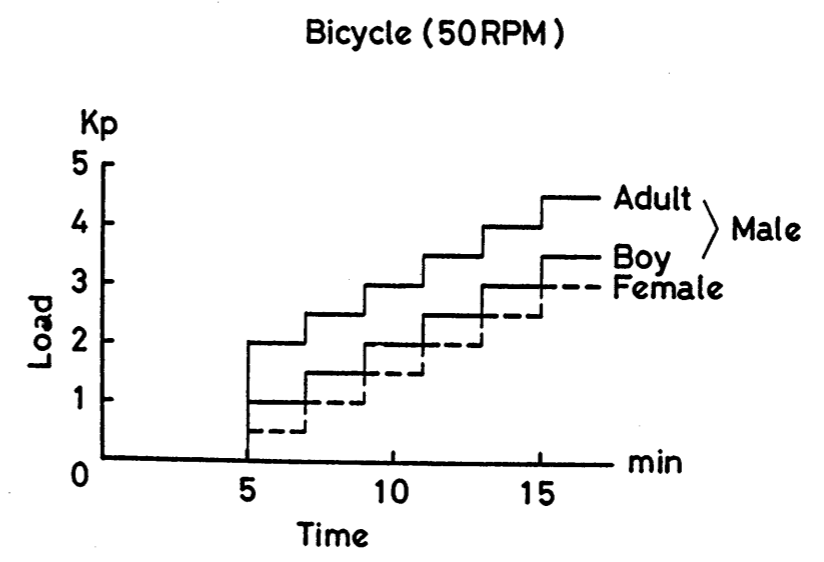


図2. 自転車エルゴメーター法の負荷設定.

Sex	Male				Female			
	19 - 34		12		19 - 26		12	
Age (years)	19 - 34		12		19 - 26		12	
Number of Subjects	32		29		21		23	
Body Height (cm)	168.2 ± 6.2		153.6 ± 6.2		156.5 ± 4.0		150.0 ± 3.7	
Body Weight (kg)	61.2 ± 9.9		43.7 ± 6.0		52.1 ± 5.5		41.1 ± 7.4	
Method	Treadmill	Bicycle	Treadmill	Bicycle	Treadmill	Bicycle	Treadmill	Bicycle
Max. Ventilation (l/min)	111.9 ± 30.7	114.9 ± 24.1	70.5 ± 15.4	71.2 ± 18.6	78.4 ± 15.5	73.1 ± 13.8	49.3 ± 12.2	58.7 ± 14.0
Max. Oxygen Intake (l/min)	2.84 ± 0.60	2.76 ± 0.49	1.90 ± 0.46	1.84 ± 0.40	1.94 ± 0.43	1.74 ± 0.30	1.31 ± 0.26	1.53 ± 0.31
Max. Oxygen Intake per Body Weight (ml/kg.min)	46.4 ± 7.40	45.6 ± 7.87	43.2 ± 6.72	42.2 ± 7.90	36.4 ± 4.21	33.7 ± 5.68	31.5 ± 4.23	37.3 ± 7.75
Tidal Volume (L)	2.11 ± 0.35	2.18 ± 0.35	1.35 ± 0.28	1.35 ± 0.33	1.55 ± 0.27	1.49 ± 0.30	1.02 ± 0.20	1.26 ± 0.29
Max. Heart Rate (beats/min)	193.0 ± 8.2	186.1 ± 11.6	193.7 ± 9.1	182.7 ± 19.5	191.3 ± 11.7	180.9 ± 10.2	188.7 ± 7.5	184.5 ± 9.8
Max. Respiratory Rate (freq./min)	52.4 ± 13.1	52.6 ± 14.2	52.9 ± 9.2	50.3 ± 8.9	50.5 ± 6.2	49.8 ± 7.8	49.5 ± 8.5	47.1 ± 7.9

(Mean ± S.D.)

表1. トレッドミル歩行法 及び 自転車エルゴメーター法による
最大酸素摂取量測定結果の比較.

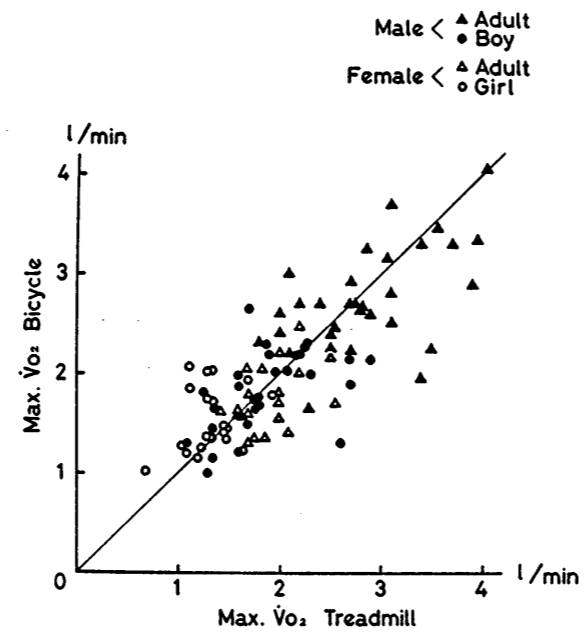


図3. トレッドミル歩行法と自転車エルゴメーター法による最大酸素摂取量の比較.

Subjects	Age (years)	Body Height (cm)	Body Weight (kg)	Max. Oxygen Intake (l/min)			Max. Oxygen Intake per Body Weight (ml/kg.min)		
				Treadmill		Bicycle	Treadmill		Bicycle
				Running	Walking		Running	Walking	
T.T.	21	171.5	61.5	3.08	2.83	3.26	50.0	46.0	53.0
Y.K.	22	173.8	61.5	3.74	3.88	2.88	60.8	63.1	46.8
M.H.	22	155.3	53.5	2.92	2.68	2.93	54.6	50.1	54.8
Y.M.	25	164.5	50.5	3.72	2.41	2.68	73.7	47.7	53.1
Y.Y.	25	173.0	55.0	3.16	2.69	2.23	57.5	48.9	40.5
H.S.	27	167.5	65.0	3.06	3.40	2.96	47.1	52.3	45.5
M.K.	30	165.0	74.2	3.08	2.55	2.46	41.5	34.4	33.2
K.E.	32	156.2	57.5	3.27	2.72	2.64	56.9	47.3	45.9
M.M.	32	172.0	71.8	3.65	3.55	3.46	50.8	49.4	48.2
T.O.	34	172.5	61.5	3.56	3.39	3.32	57.9	55.1	54.0
Mean	27	167.1	61.2	3.32	3.01	2.88	55.1	49.4	47.5
S.D.	4.5	6.5	7.2	0.30	0.47	0.37	8.30	6.88	6.47

表2. トレッドミルランニング法, トレッドミル歩行法, 自転車エルゴメーター法による
最大酸素摂取量測定結果の比較.

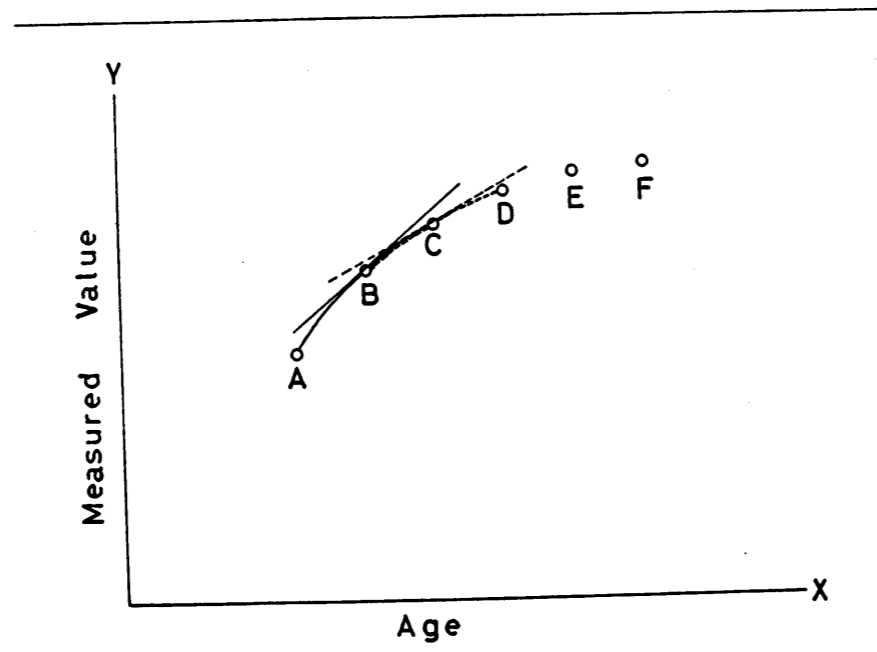


図4. 発育発達速度の算出法

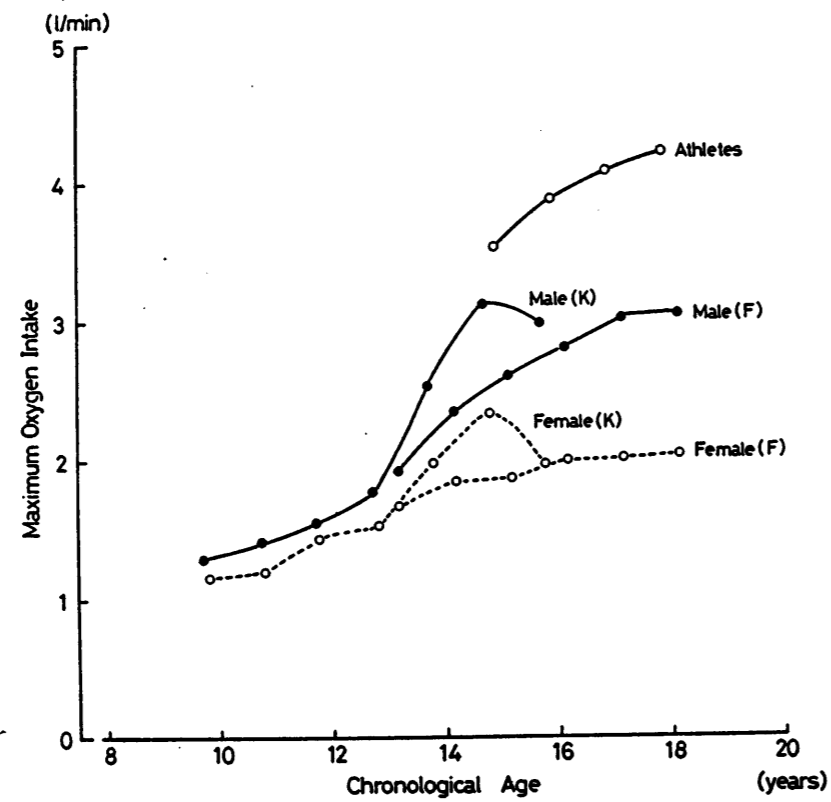


図5. 年齢別平均値からみた
最大酸素摂取量の発達.

K: ヌリ谷グループ
F: 附属グループ
Athletes: 陸上選手グループ

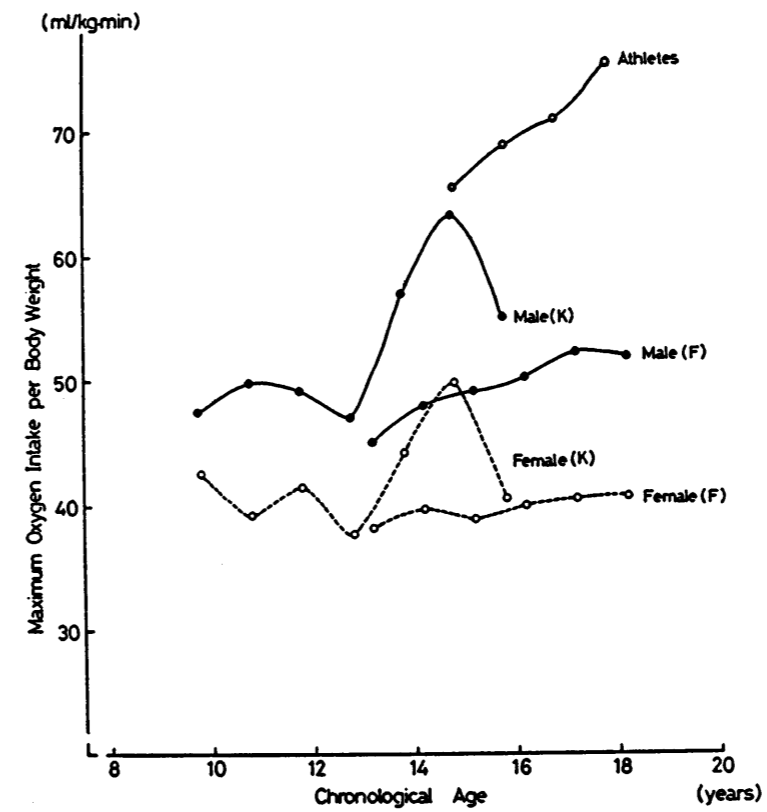


図6. 年齢別平均値からみた、体重あたり
最大酸素摂取量の発達

K: ヌリ谷グループ
F: 附属グループ
Athletes: 陸上選手グループ

Items	School Age						
	Elementary School 4	5	6	Junior High School 1	2	3	High School 1
Age (years)	9.69 ± 0.36	10.69 ± 0.36	11.69 ± 0.36	12.69 ± 0.36	13.69 ± 0.36	14.67 ± 0.36	15.78 ± 0.38
Number	7	7	7	7	7	7	5
Body Height (cm)	131.3 ± 1.36	135.4 ± 1.38	140.7 ± 2.00	146.8 ± 3.63	156.2 ± 2.80	162.9 ± 3.19	166.4 ± 2.98
Body Weight (kg)	27.1 ± 1.02	29.4 ± 1.19	32.2 ± 2.02	37.7 ± 2.25	43.5 ± 1.65	49.5 ± 2.66	53.5 ± 3.13
Max. Ventilation (STPD) (l/min)	38.8 ± 2.46	45.3 ± 7.30	47.6 ± 11.76	62.8 ± 9.40	73.3 ± 4.59	95.3 ± 11.18	84.7 ± 10.17
Max. Oxygen Intake (l/min)	1.29 ± 0.08	1.42 ± 0.15	1.55 ± 0.20	1.77 ± 0.13	2.54 ± 0.15	3.13 ± 0.27	3.00 ± 0.28
Max. Oxygen Intake per Body Weight (ml/kg.min)	47.5 ± 2.55	49.8 ± 4.53	49.2 ± 4.67	47.0 ± 4.36	56.9 ± 2.72	63.2 ± 4.05	55.0 ± 3.08
Max. Heart Rate (beats/min)	196.9 ± 3.8	195.2 ± 6.0	-	191.9 ± 4.0	199.0 ± 3.9	190.1 ± 6.9	192.7 ± 8.5
Max. Respiratory Rate (freq./min)	-	-	-	56.4 ± 12.4	54.2 ± 8.6	61.6 ± 12.8	54.3 ± 12.2

Results for Kariya Group (Male)

(Mean ± S.D.)

表3. 最大酸素摂取量の縦断的測定結果 (刈谷グループ男子)

Items	School Age						
	Elementary School 4	5	6	Junior High School 1	2	3	High School 1
Age (years)	9.80 ± 0.26	10.80 ± 0.26	11.80 ± 0.26	12.80 ± 0.26	13.80 ± 0.26	14.84 ± 0.24	15.87 ± 0.26
Number	9	9	9	9	9	8	6
Body Height (cm)	130.6 ± 1.80	135.8 ± 2.08	142.7 ± 3.02	148.8 ± 2.89	152.2 ± 2.91	154.2 ± 3.65	154.8 ± 4.49
Body Weight (kg)	27.2 ± 1.72	30.6 ± 2.57	35.0 ± 3.35	40.7 ± 3.93	45.1 ± 3.92	47.3 ± 4.06	48.7 ± 4.44
Max. Ventilation (STPD) (l/min)	36.9 ± 3.64	43.4 ± 6.89	41.4 ± 5.72	56.8 ± 9.15	62.6 ± 9.96	70.6 ± 6.32	65.9 ± 5.73
Max. Oxygen Intake (l/min)	1.16 ± 0.11	1.20 ± 0.12	1.44 ± 0.12	1.53 ± 0.15	1.98 ± 0.22	2.34 ± 0.13	1.96 ± 0.13
Max. Oxygen Intake Per Body Weight (ml/kg.min)	42.6 ± 4.32	39.2 ± 3.17	41.5 ± 1.59	37.7 ± 3.33	44.2 ± 4.07	49.8 ± 4.07	40.5 ± 2.59
Max. Heart Rate (beats/min)	205.6 ± 7.4	205.8 ± 12.4	-	202.6 ± 6.4	199.0 ± 7.3	197.8 ± 9.3	197.2 ± 8.3
Max. Respiratory Rate (freq./min)	-	-	-	50.6 ± 7.3	49.8 ± 6.7	54.7 ± 6.9	54.7 ± 6.8

Results for Kariya Group (Female)

(Mean ± S.D.)

表4. 最大酸素摂取量の縦断的測定結果 (刈谷グループ女子)

Items	School Age					
	Junior High School 1	2	3	High School 1	2	3
Age (years)	13.16 ± 0.26	14.16 ± 0.26	15.16 ± 0.26	16.16 ± 0.26	17.16 ± 0.26	18.16 ± 0.26
Number	43	43	43	43	43	43
Body Height (cm)	152.7 ± 3.50	160.7 ± 3.50	165.6 ± 3.16	168.0 ± 3.80	168.9 ± 3.82	169.4 ± 3.98
Body Weight (kg)	42.7 ± 4.58	49.0 ± 5.38	53.6 ± 6.18	56.5 ± 5.76	58.2 ± 5.84	59.1 ± 6.36
Max. Ventilation (STPD) (l/min)	62.8 ± 9.95	75.1 ± 12.17	85.0 ± 12.22	94.0 ± 13.79	97.2 ± 12.70	93.8 ± 14.21
Max. Oxygen Intake (l/min)	1.91 ± 0.21	2.34 ± 0.28	2.61 ± 0.29	2.81 ± 0.35	3.02 ± 0.36	3.05 ± 0.38
Max. Oxygen Intake per Body Weight (ml/kg.min)	45.0 ± 5.34	48.0 ± 5.49	49.1 ± 4.41	50.2 ± 3.14	52.2 ± 5.09	51.8 ± 6.31
Max. Heart Rate (beats/min)	196.8 ± 8.6	197.0 ± 9.5	196.4 ± 8.6	193.7 ± 9.5	193.9 ± 8.8	192.6 ± 8.7
Max. Respiratory Rate (freq./min)	55.9 ± 10.0	58.5 ± 10.6	54.7 ± 10.6	53.6 ± 9.9	52.0 ± 9.6	52.2 ± 10.5

(Mean ± S.D.)

Results for Fuzoku Group (Male)

表5, 最大酸素摂取量の縦断的測定結果、(附属グループ男子)

Items	School Age					
	Junior High School 1	2	3	High School 1	2	3
Age (years)	13.18 ± 0.28	14.18 ± 0.28	15.18 ± 0.28	16.18 ± 0.28	17.18 ± 0.28	18.18 ± 0.28
Number	38	38	38	38	38	38
Body Height (cm)	151.3 ± 2.89	153.5 ± 3.09	154.7 ± 3.44	155.1 ± 3.67	155.3 ± 3.26	155.3 ± 3.36
Body Weight (kg)	44.0 ± 4.51	47.0 ± 4.60	48.4 ± 4.60	49.9 ± 4.23	50.3 ± 3.88	49.6 ± 4.26
Max. Ventilation (STPD) (l/min)	55.4 ± 7.49	59.2 ± 11.35	62.6 ± 9.01	65.0 ± 8.80	67.5 ± 8.85	64.7 ± 9.05
Max. Oxygen Intake (l/min)	1.67 ± 0.19	1.84 ± 0.26	1.87 ± 0.21	2.00 ± 0.26	2.00 ± 0.24	2.03 ± 0.31
Max. Oxygen Intake per Body Weight (ml/kg.min)	38.1 ± 5.26	39.7 ± 5.73	38.9 ± 3.77	40.1 ± 5.11	40.5 ± 4.98	40.7 ± 5.31
Max. Heart Rate (beats/min)	195.9 ± 9.8	191.8 ± 7.4	190.2 ± 8.2	189.3 ± 7.2	191.2 ± 7.7	189.2 ± 7.8
Max. Respiratory Rate (freq./min)	-	-	48.9 ± 9.5	50.0 ± 6.9	50.1 ± 6.2	49.8 ± 7.6

(Mean ± S.D.)

Results for Fuzoku Group (Female)

表6. 最大酸素摂取量の縦断的測定結果。(附属グループ女子)

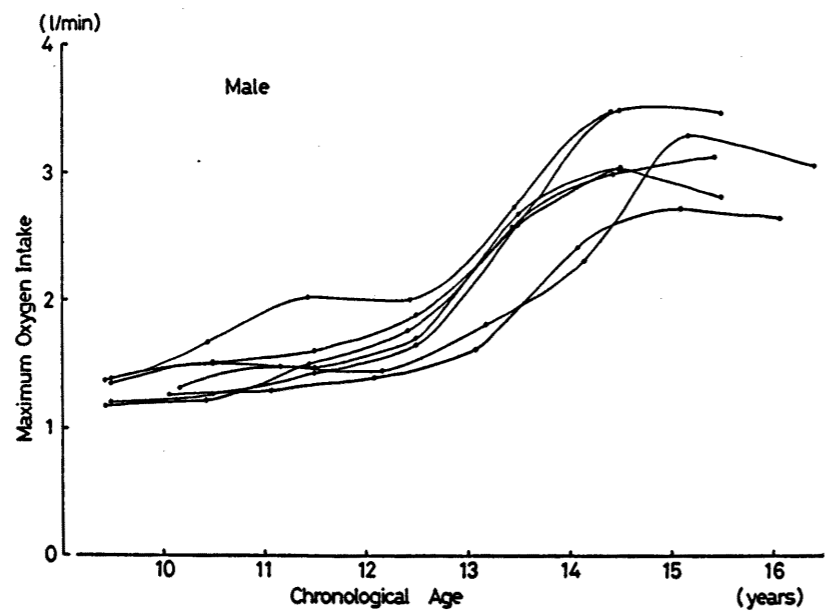


図7. 個人別最大酸素摂取量の発達.
(刈谷グループ^o 男子).

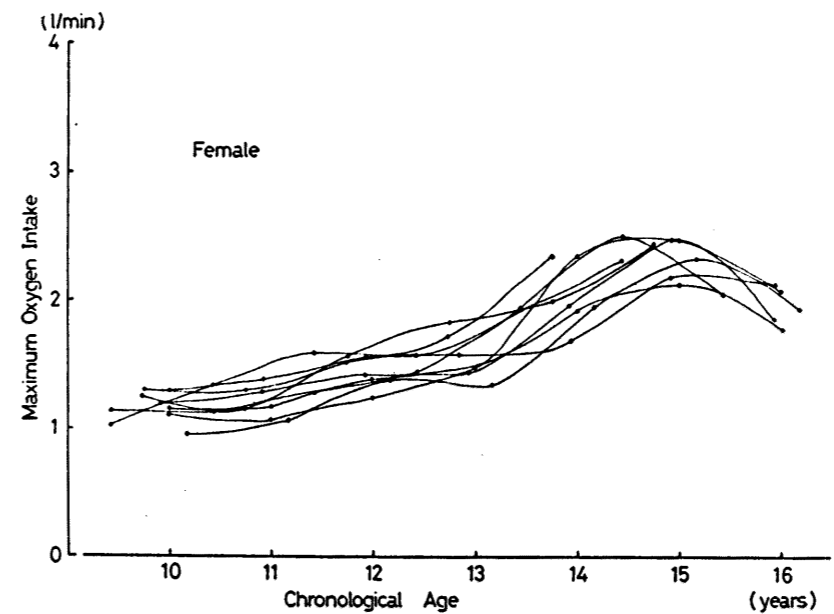


図8. 個人別最大酸素摂取量の発達.
(刈谷グループ^o 女子)

School Age	Elementary School 4	5	6	Junior High School 1	2	3	High School 1
Male Age (Mean) (years)	9.69	10.69	11.69	12.69	13.69	14.69	15.78
K-001	1.34*	1.51*	1.58*	1.87*	2.57*	3.03*	----
K-002	1.31	1.50	1.44	1.82	2.28	3.27	3.03*
K-003	1.25	1.29	1.38	1.58	2.38	2.68	2.62
K-004	1.36	1.50	1.48	1.68	2.66	3.01	2.80
K-005	1.20	1.26	1.42	1.65	2.57	3.48	3.43
K-006	1.17	1.21	1.53	1.76	2.58	2.98	3.12
K-007	1.38	1.66	2.01	2.00	2.77	3.45	----
Female Age (Mean) (years)	9.80	10.80	11.80	12.80	13.80	14.84	15.87
K-101	1.15*	1.13*	1.29*	1.44*	1.92*	2.48*	2.05*
K-102	1.30	1.38	1.56	1.57	1.59	2.19	2.12
K-103	0.97	1.06	1.38	1.34	1.93	2.32	1.92
K-104	1.15	1.15	1.37	1.47	1.87	2.09	1.76
K-105	1.19	1.29	1.42	1.42	1.95	2.46	1.86
K-106	1.11	1.04	1.25	1.46	2.33	2.46	2.07
K-107	1.25	1.13	1.56	1.83	1.99	2.44	----
K-108	1.30	1.30	1.52	1.71	2.34	----	----
K-109	1.00	1.31	1.59	1.55	1.90	2.30	----

* 1/min

表 7. 最大酸素摂取量の個人別縦断的測定結果。(刈谷グリーフ)

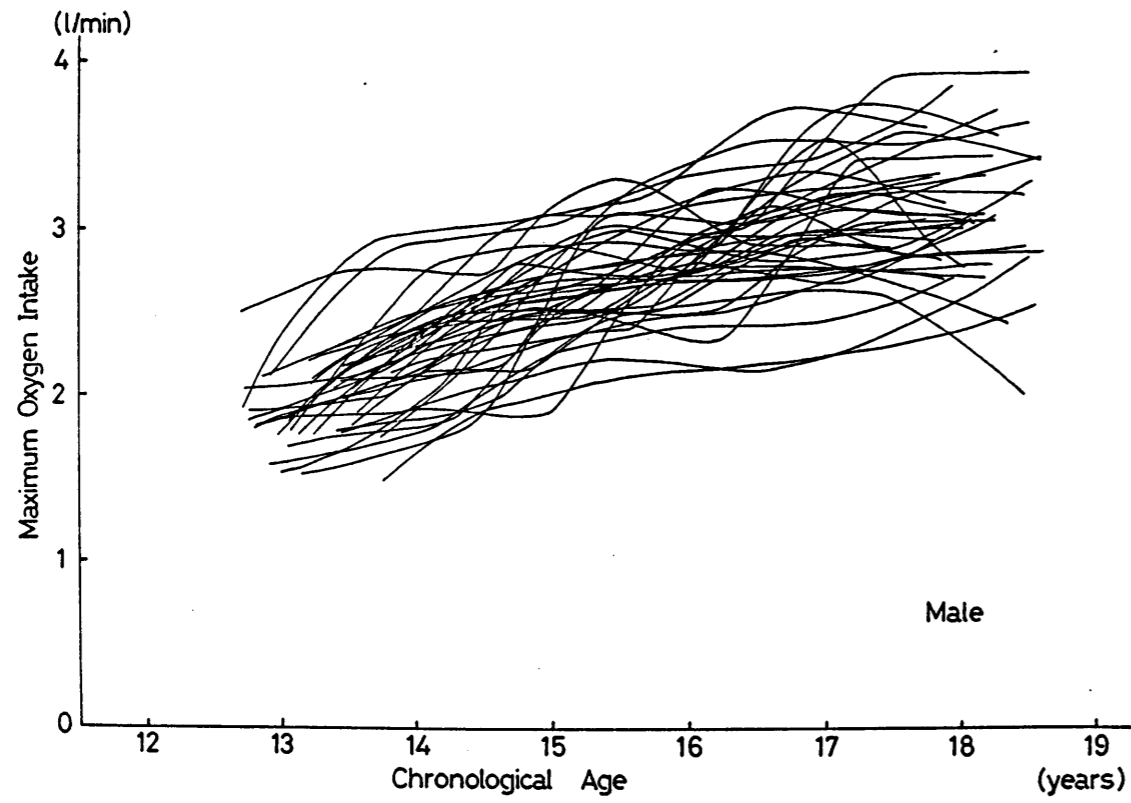


図9. 個人別最大酸素摂取量の発達.
(附属グループ男子)

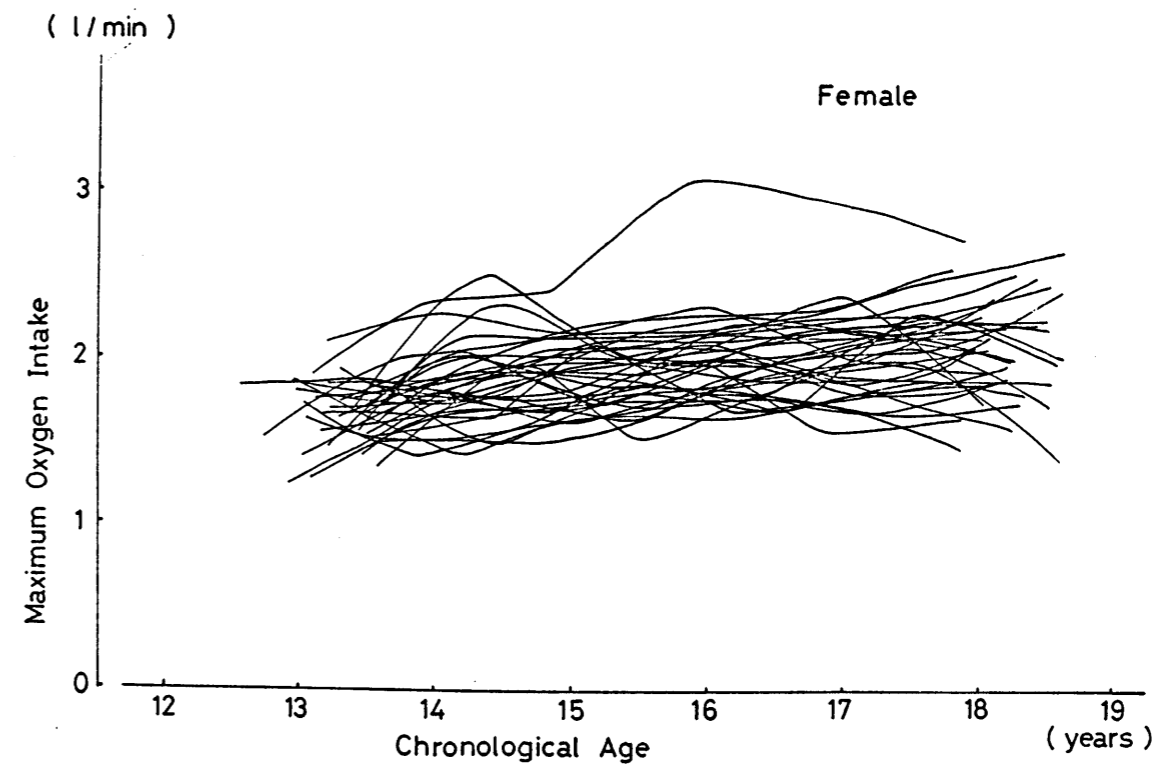


図10. 個人別最大酸素摂取量の発達.
(附属グループ女子)

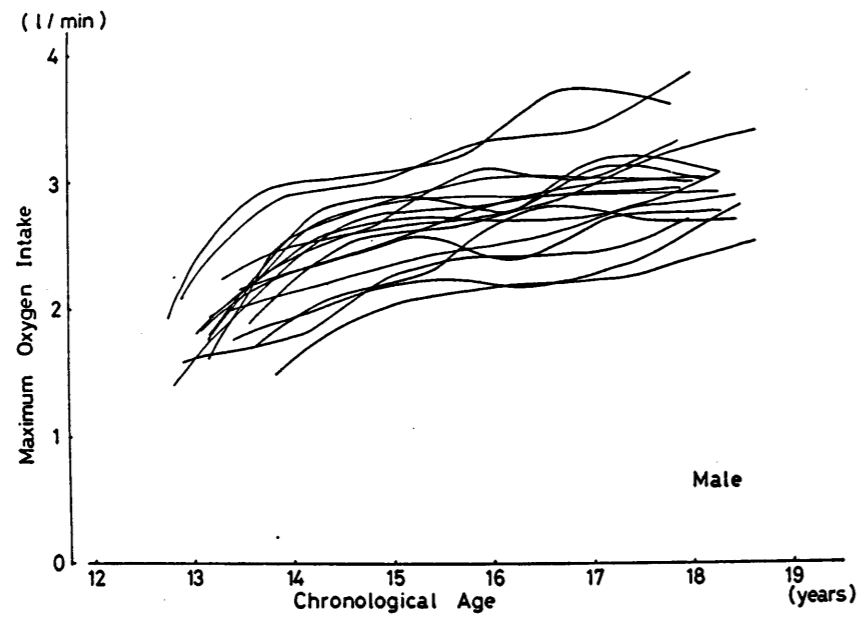


図11、滑らかな最大酸素摂取量増大パターン。
(男子カ1型)

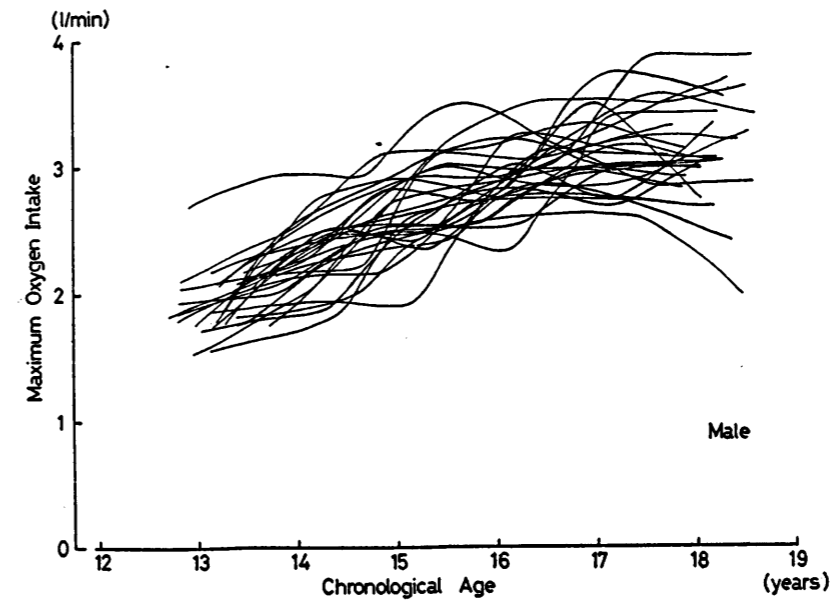


図12、途中急増パターン。
(男子カ2型)

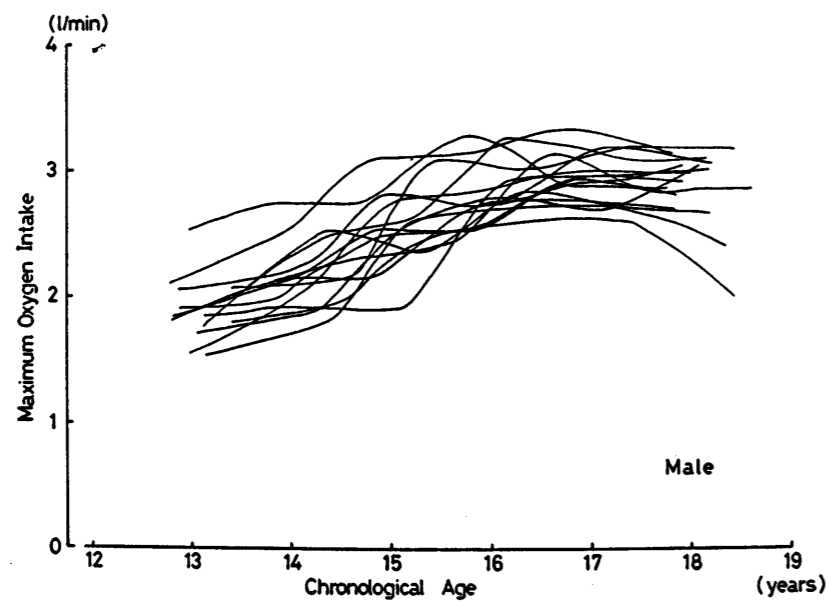


図13、途中急増後、安定パターン。
(男子カ2(a)型)

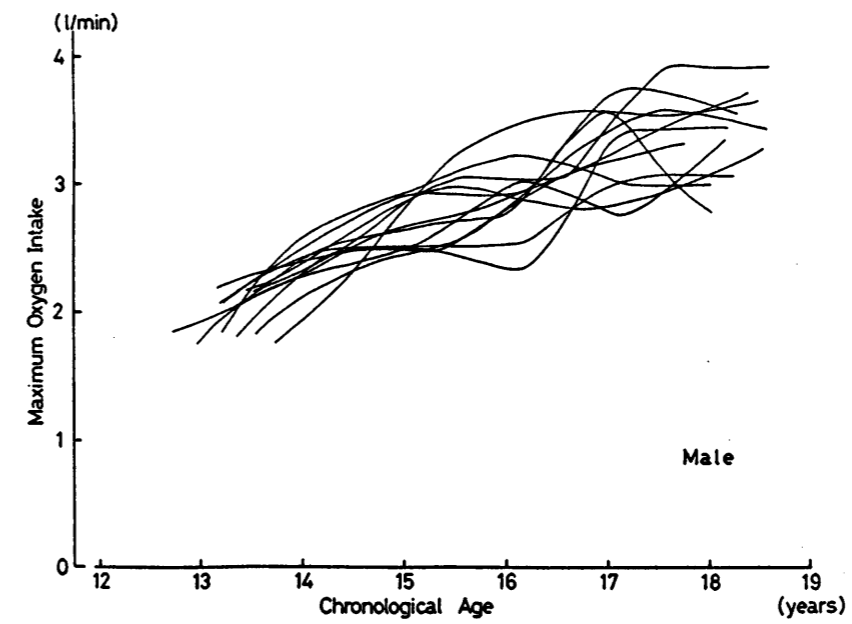


図14、増大持続後、更に急増パターン。
(男子カ2(b)型)

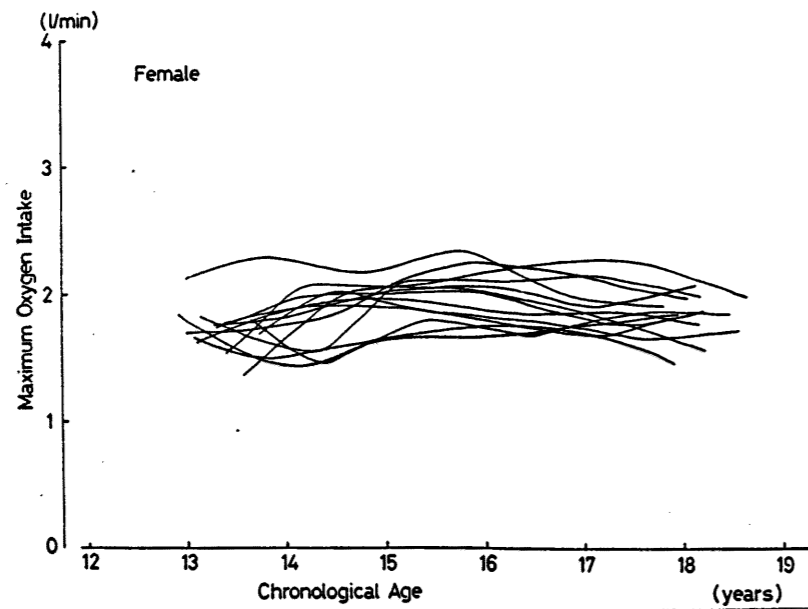


図15、無変化パターン。
(女子才1型)

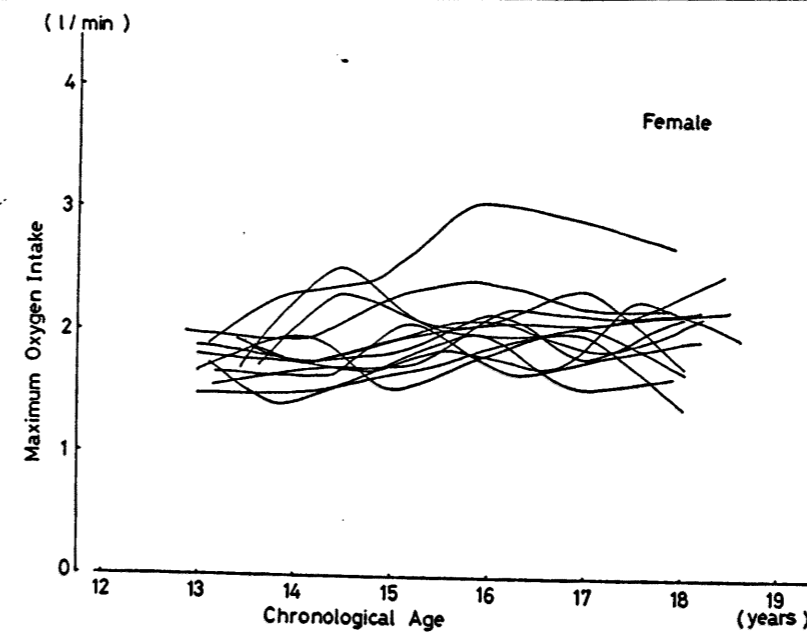


図16、極大値形成パターン。
(女子才2型)

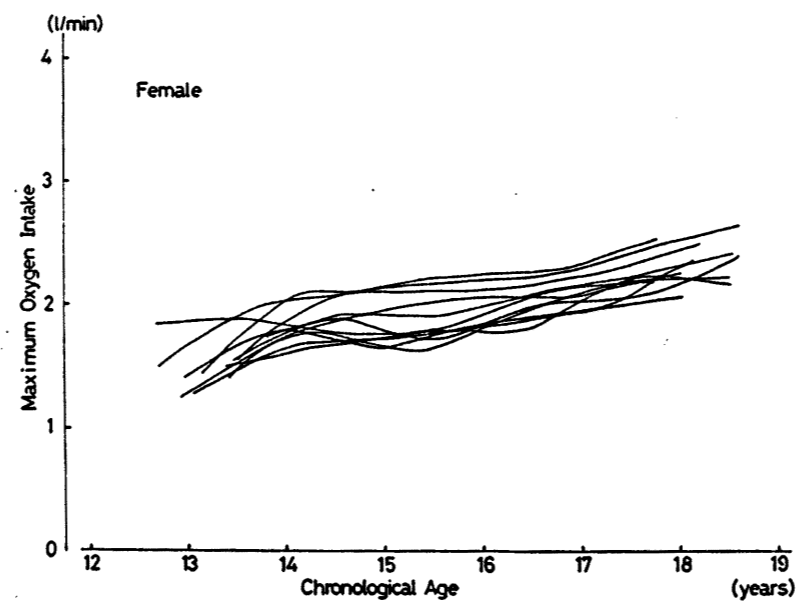


図17、増大基調持続パターン。
(女子才3型)

School Age	Junior High School 1	2	3	High School 1	2	3
Age (Mean) (years)	13.16	14.16	15.16	16.16	17.16	18.16
Subject (Male)						
6001	2.05*	2.25*	2.80*	2.70*	2.92*	3.03*
6002	1.55	2.10	2.75	2.86	3.00	2.99
6003	1.59	1.80	2.22	2.41	2.42	2.68
6005	1.84	2.27	2.59	2.79	3.09	3.30
6006	1.84	2.16	2.54	2.51	2.95	2.81
6007	2.11	2.54	3.09	3.12	3.34	3.14
6008	1.80	2.15	2.14	2.70	2.76	2.69
6010	1.70	1.87	2.52	2.79	2.67	3.03
6011	2.08	2.18	3.09	3.02	3.21	3.18
6012	1.54	1.81	2.60	2.70	2.74	2.68
6013	1.81	2.02	2.47	2.57	2.59	1.99
6015	1.77	2.51	2.41	3.24	3.12	3.08
6016	1.81	2.41	2.54	3.12	3.56	3.40
6017	1.98	2.25	2.42	2.53	2.80	2.88
6018	1.85	1.92	1.89	2.94	2.96	3.03
7001	1.73	2.10	2.29	2.78	2.71	2.70
7002	1.76	2.28	3.15	3.51	3.49	3.61
7003	1.63	2.53	2.80	3.00	3.04	3.00
7004	1.85	2.34	2.64	3.09	3.22	3.31
7005	2.16	2.32	2.59	2.70	2.74	2.77
7007	1.49	1.90	2.12	2.19	2.29	2.52
7009	1.92	2.12	2.33	2.63	2.79	2.82
7013	2.14	2.29	2.40	3.12	2.83	2.85
7014	1.85	2.56	2.90	3.20	3.01	2.98
7015	2.25	2.50	2.64	2.73	3.10	3.01
7016	2.51	2.73	2.72	3.29	2.89	2.87
7018	2.05	2.52	2.33	2.85	2.70	2.42
7020	2.04	2.29	2.50	3.00	2.71	3.32
8001	1.76	2.04	2.23	2.15	2.37	2.81
8002	2.14	2.64	3.03	3.01	3.89	3.89
8003	1.79	2.73	2.90	2.73	3.18	3.06
8004	2.18	2.57	2.98	2.81	2.88	3.26
8007	2.10	2.60	2.92	2.90	3.73	3.54
8008	1.75	2.36	2.61	2.72	3.52	2.75
8009	1.77	2.64	2.84	2.89	2.90	2.90
8010	2.19	2.40	2.49	2.60	3.40	3.41
8011	1.98	2.56	2.70	2.68	2.76	3.05
8012	2.08	2.48	2.52	2.52	3.01	3.04
8014	1.91	2.54	2.64	2.83	3.16	3.39
8015	1.78	2.47	2.46	3.00	3.34	3.78
8016	1.92	1.99	2.48	2.54	2.96	2.91
8017	2.11	2.91	3.01	3.31	3.41	3.83
8020	1.93	2.95	3.05	3.19	3.72	3.60

表 8. 最大酸素摂取量の個人別縦断的測定結果。(附属グループ男子)
* l/min.

School Age	Junior High School 1	2	3	High School 1	2	3
Age (mean) (years)	13.18	14.18	15.18	16.18	17.18	18.18
Subject (Female)						
6101	1.86*	1.75*	1.80*	2.15*	1.78*	2.12*
6102	2.00	1.92	2.20	2.41	2.20	2.19
6104	1.87	1.41	1.63	1.64	1.75	1.84
6106	1.80	1.74	1.92	2.05	2.37	1.72
6108	1.83	1.86	2.09	2.09	2.17	1.98
6110	1.69	1.77	2.04	2.23	2.13	1.97
6111	1.49	1.49	1.64	1.84	1.98	1.39
6112	1.55	1.70	1.71	2.19	2.12	2.17
6114	1.84	1.66	1.85	1.68	2.27	1.96
6115	1.63	1.93	1.97	1.86	1.86	1.77
6116	1.63	1.59	1.60	2.00	2.01	1.82
6117	1.65	1.63	2.07	1.67	1.80	1.94
6120	1.67	1.96	1.52	1.90	2.05	1.69
7103	1.74	1.98	1.98	1.98	1.77	1.84
7104	2.12	2.27	2.14	2.34	1.98	1.91
7105	1.55	2.04	1.71	1.98	1.78	1.56
7106	1.88	2.29	2.39	3.03	2.93	2.70
7107	1.93	1.73	1.94	2.07	1.83	2.11
7108	1.77	1.45	1.79	1.65	1.84	1.84
7111	1.64	1.48	1.60	1.71	1.71	1.45
7112	1.71	1.40	1.65	1.97	1.55	1.63
7113	1.76	1.82	2.02	2.07	1.89	2.07
7115	1.72	2.29	2.00	2.08	2.13	2.46
7116	1.69	2.00	1.81	1.77	1.65	1.71
7117	1.75	1.91	1.70	2.00	2.05	2.38
7120	1.77	1.89	1.88	1.78	1.66	1.86
8101	1.51	2.00	2.09	2.23	2.27	2.52
8102	1.84	1.88	1.76	1.84	2.13	2.12
8104	1.24	1.71	1.92	2.00	2.05	2.25
8105	1.41	1.79	1.62	1.82	1.94	2.06
8106	1.46	2.12	2.11	2.14	2.43	2.50
8111	1.52	1.67	1.77	1.78	2.21	2.16
8112	1.70	2.51	2.02	1.96	2.10	2.19
8114	1.54	1.92	1.90	2.10	2.22	2.42
8115	1.36	1.98	2.07	2.21	2.25	1.99
8116	1.29	1.66	1.73	1.83	1.95	1.98
8117	1.59	2.07	2.17	2.24	2.43	2.63
8120	1.41	1.79	1.61	1.95	2.19	2.22

表9. 最大酸素摂取量の個人別縦断的測定結果* (1/min 附属グループ女子)

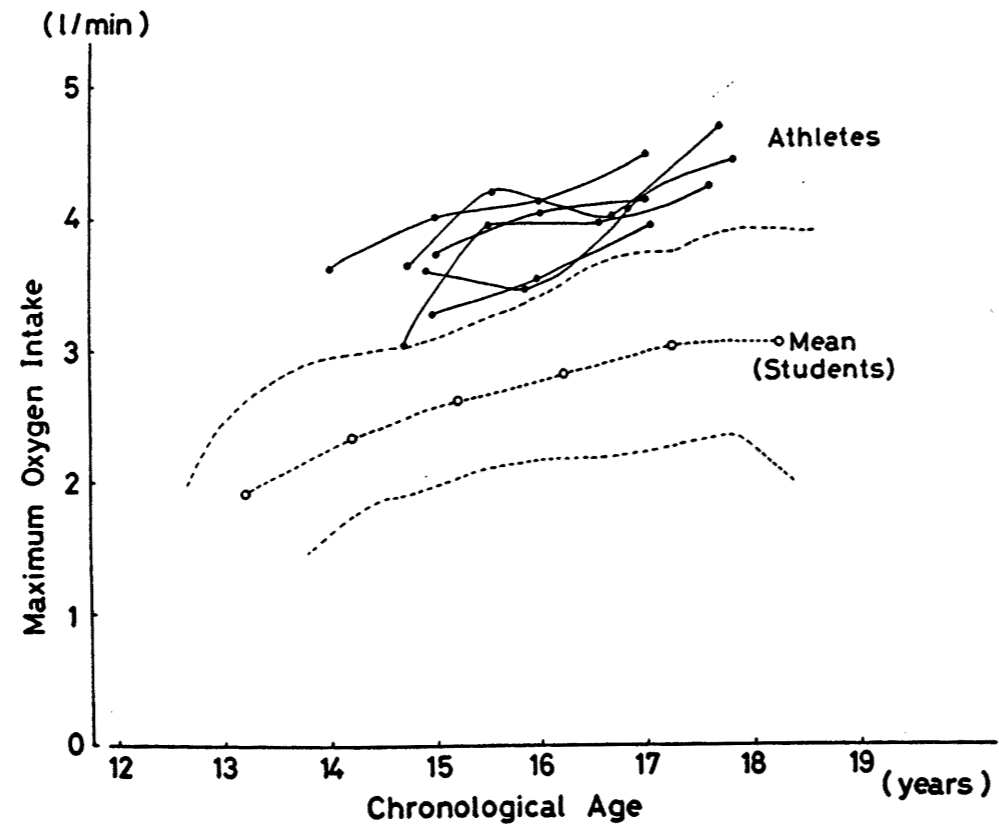


図18. ジュニア陸上選手の最大酸素摂取量。
 (破線は、附属グループ男子の平均値)
 (及び最大値, 最小値の範囲を示す。)

Subject	Age (years)	Body Height (cm)	Body Weight (kg)	\dot{V}_e max. (STPD) (l/min)	$\dot{V}o_2$ max. (l/min)	$\dot{V}o_2$ max./W (ml/kg.min)	Max.H.R. (beats/min)	Max.R.R. (freq./min)	Running Records.
R-001	14.00	172.6	52.5	119.9	3.62	69.0	207	66	800M:2'11"0.
	15.00	175.8	55.5	138.4	4.00	72.1	207	70	800M:2'03"2.
	15.92	178.9	61.0	134.0	4.12	69.2	206	65	800M:2'01"6.
	16.92	178.9	63.5	136.4	4.46	70.2	202	60	800M:1'59"5
R-002	15.00	163.2	51.5	120.0	3.72	72.2	197	64	2000M:5'52"4.
	16.00	164.5	53.5	117.3	4.03	75.3	207	64	800M:2'01"3. 1500M:4'08"5.
	17.17	165.0	54.5	118.9	4.12	75.7	201	61	800M:1'58"6. 1500M:4'03"3.
R-003	14.92	168.5	52.5	130.5	3.26	62.1	204	82	2000M:6'06"0
	15.92	170.4	55.0	112.4	3.51	63.8	209	83	800M:2'01"9
	17.08	170.8	57.0	131.1	3.93	68.9	204	83	800M:1'59"5
R-004	14.58	167.8	53.0	99.8	3.03	57.2	199	64	2000M:6'07"4.
	15.50	168.9	57.0	123.5	3.94	69.1	191	62	5000M:16'20"0.
	16.58	169.4	58.5	120.1	3.94	67.4	193	65	5000M:14'53"2.
	17.58	169.4	59.5	118.3	4.21	70.8	195	62	1500M:4'01"6. 5000M:15'08"2.
R-005	14.67	173.4	59.0	115.1	3.63	61.5	195	53	2000M:6'07"6.
	15.58	173.4	59.5	133.9	4.18	70.3	189	56	1500M:4'15"0. 5000M:15'59"0.
	16.67	174.7	62.5	137.9	3.94	63.0	186	62	800M:2'00"9. 1500M:4'04"0. 5000M:15'27"6.
	17.67	174.5	62.5	153.4	4.67	74.6	176	63	800M:1'55"1. 1500M:3'59"2. 5000M:15'08"0.
R-006	14.83	161.8	53.5	119.3	3.60	67.3	201	78	2000M:6'11"6.
	15.75	161.8	54.0	127.5	3.47	64.3	184	95	1500M:4'16"0. 5000M:16'02"0.
	16.83	162.4	57.0	133.6	4.10	72.0	188	88	1500M:4'10"0. 5000M:15'25"0.
	17.83	162.0	55.0	135.9	4.41	80.1	195	64	1500M:4'04"2. 5000M:15'11"4.

表10. 最大酸素摂取量の個人別縦断的測定結果。(陸上選手グループ)

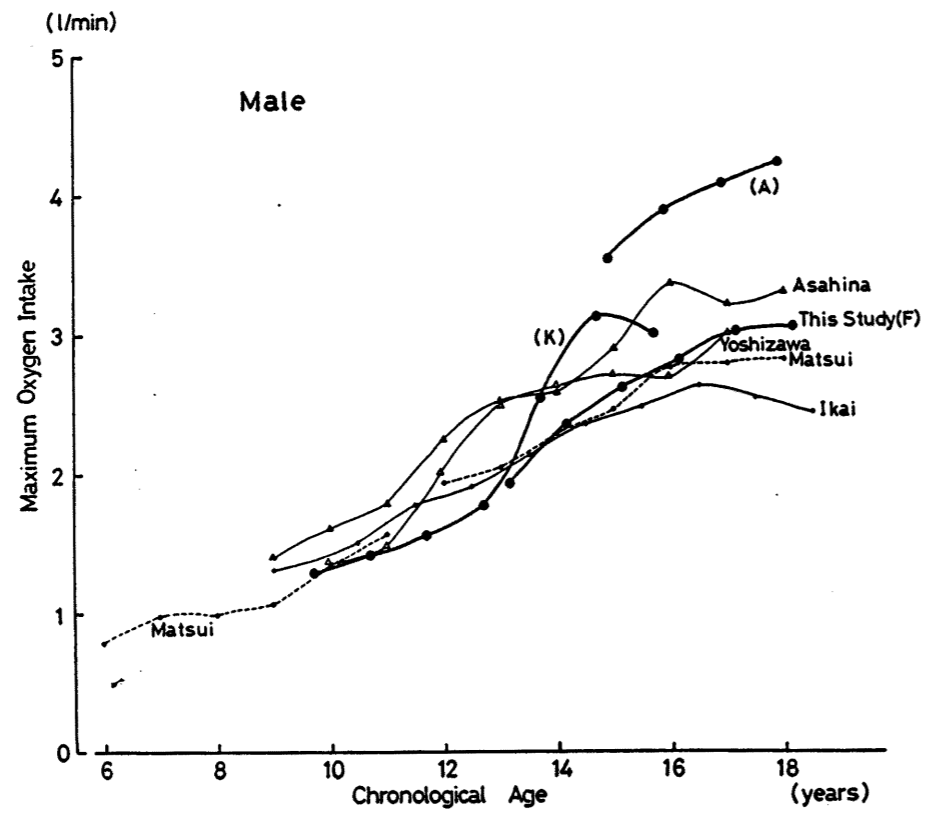


図19. 最大酸素摂取量の比較(男子)

K: 刈谷グループ
 F: 附属グループ
 A: 陸上選手グループ

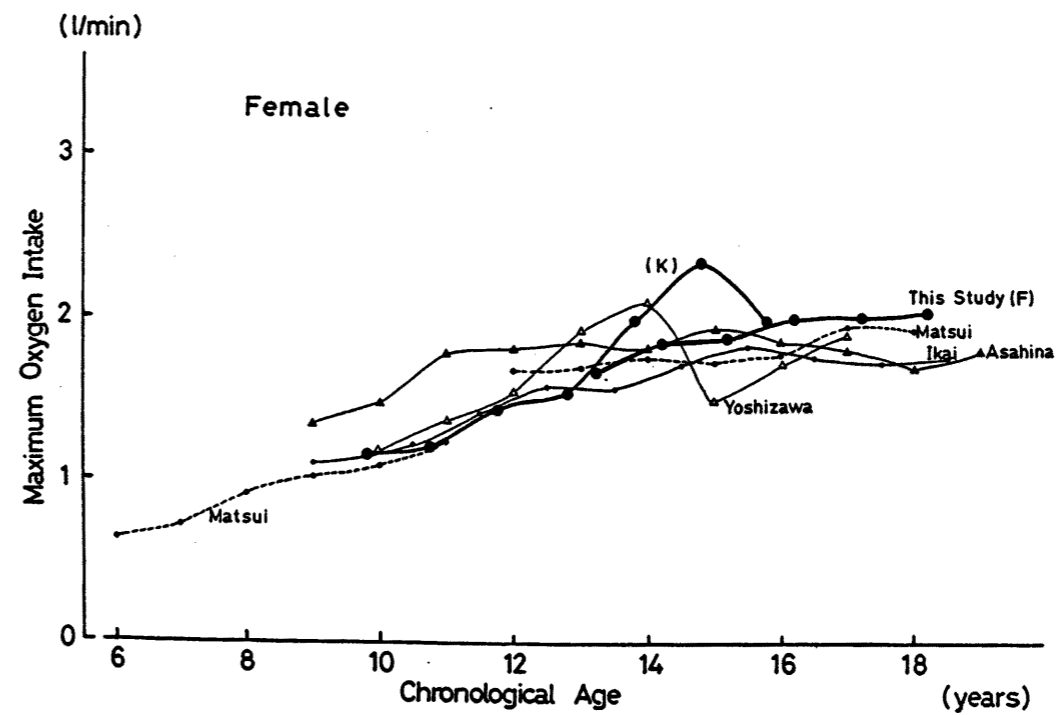


図20. 最大酸素摂取量の比較.(女子)

K: 刈谷グループ
 F: 附属グループ

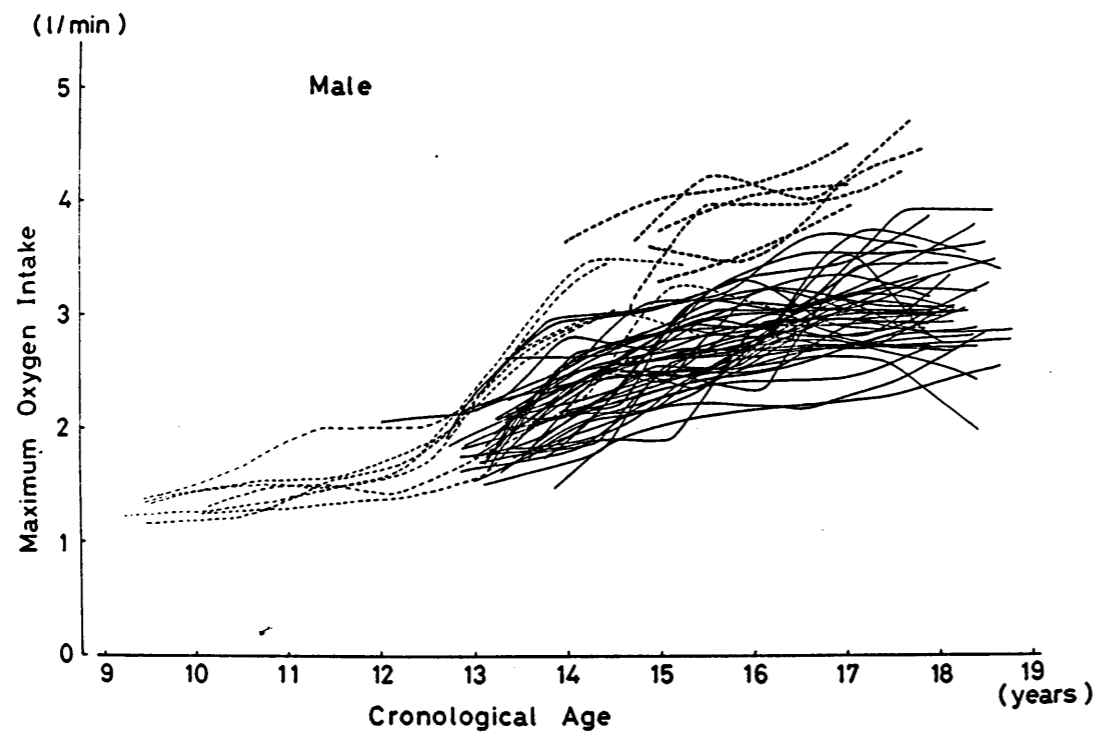


図21, 最大酸素摂取量の個人別発達曲線,
(男子).

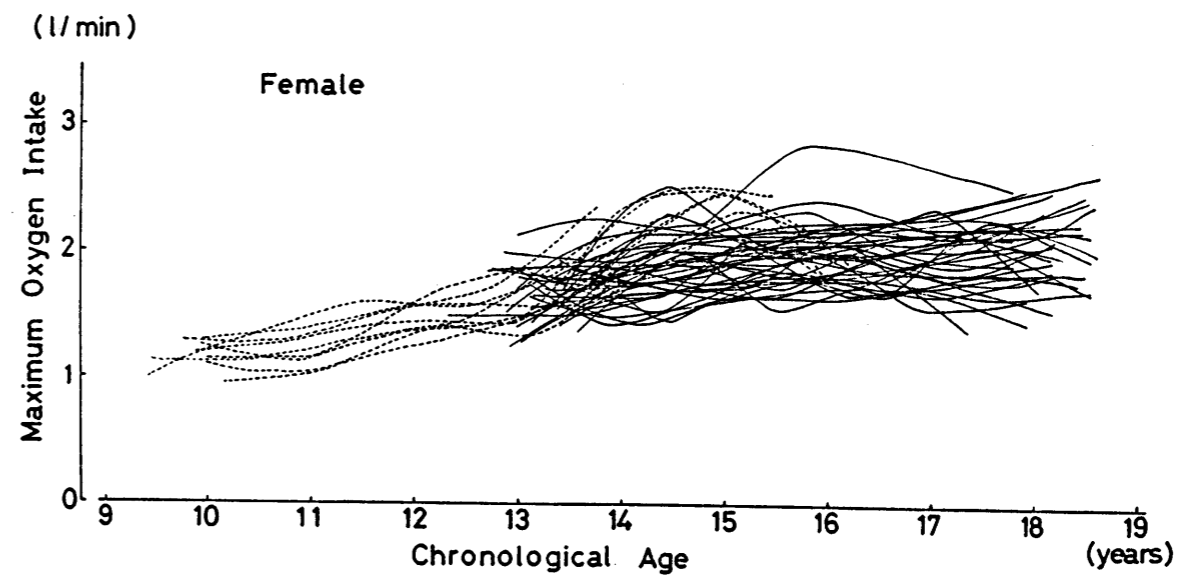


図22, 最大酸素摂取量の個人別発達曲線,
(女子).

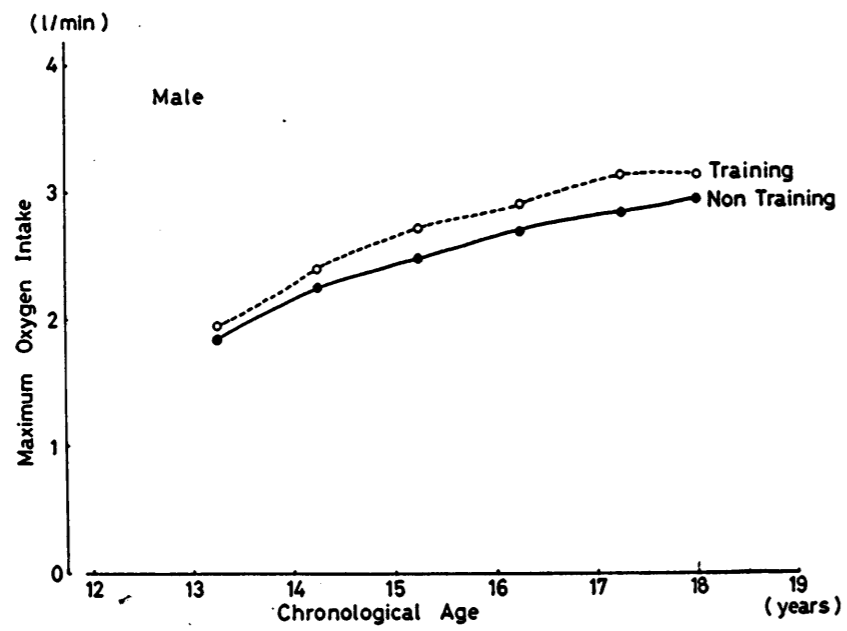


図23. 運動部所属群と非所属群の比較.
(男子).

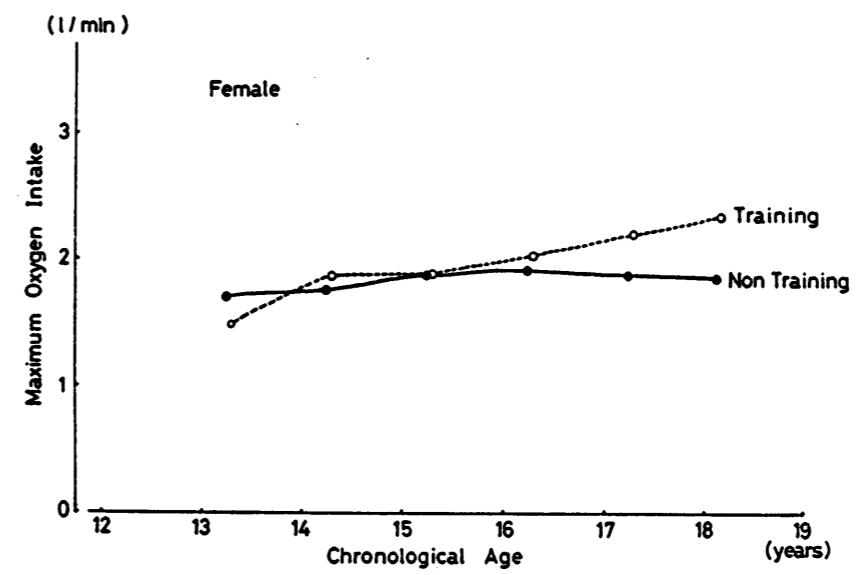


図24. 運動部所属群と非所属群の比較.
(女子).

		Junior High School			High School		
		1	2	3	1	2	3
Male Sports Club Members. N=28	Max.	2.51	2.95	3.15	3.54	3.89	3.89
	Min.	1.54	1.81	2.23	2.15	2.37	1.99
	Mean	1.94	2.39	2.70	2.89	3.12	3.12
	S.D.	0.22	0.27	0.25	0.34	0.37	0.43
Non-Active. N=15	Max.	2.25	2.73	2.90	3.20	3.18	3.32
	Min.	1.49	1.80	1.89	1.97	2.29	2.52
	Mean	1.83	2.24	2.46	2.67	2.82	2.93
	S.D.	0.19	0.29	0.29	0.32	0.24	0.22
Female Sports Club Members. N=11	Max.	1.87	2.00	2.09	2.23	2.25	2.07
	Min.	1.36	1.41	1.56	1.64	1.65	1.45
	Mean	1.70	1.75	1.87	1.90	1.88	1.85
	S.D.	0.13	0.23	0.19	0.21	0.20	0.16
Non-Active. N=9	Max.	1.75	2.12	2.17	2.24	2.43	2.63
	Min.	1.24	1.66	1.61	1.78	1.95	1.98
	Mean	1.48	1.87	1.89	2.03	2.20	2.34
	S.D.	0.15	0.16	0.19	0.15	0.16	0.19

(l/min)

表11. 運動部所属群と非所属群の最大酸素摂取量の比較。(附属グループ)

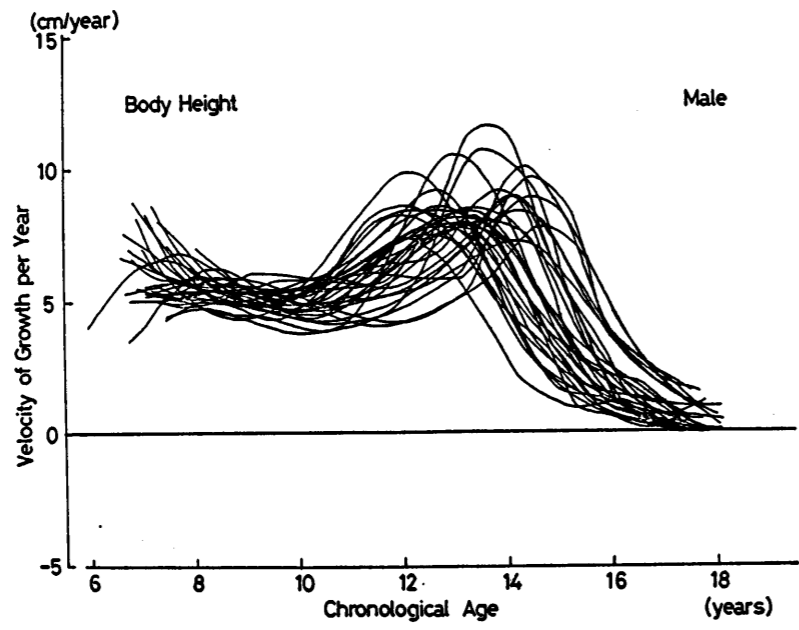


図25. 身長発育速度曲線 (男子)

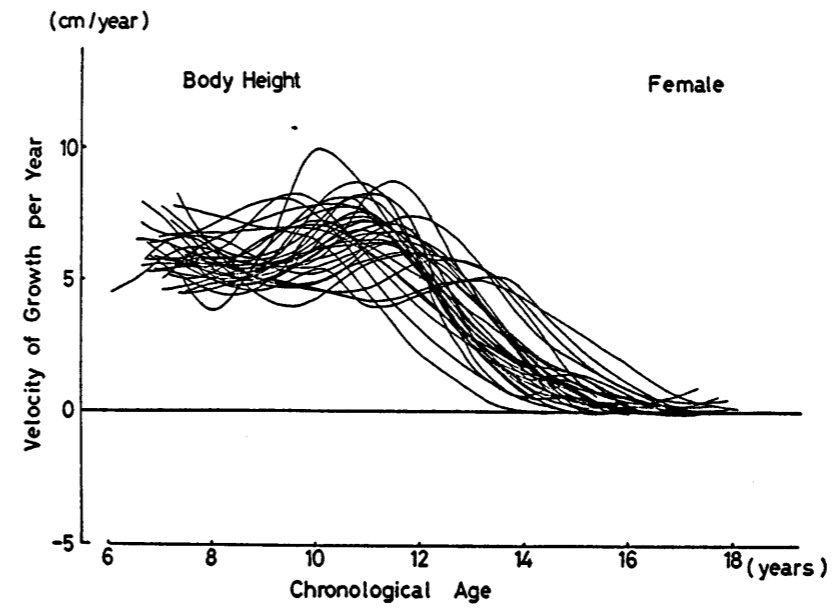


図26. 身長発育速度曲線 (女子)

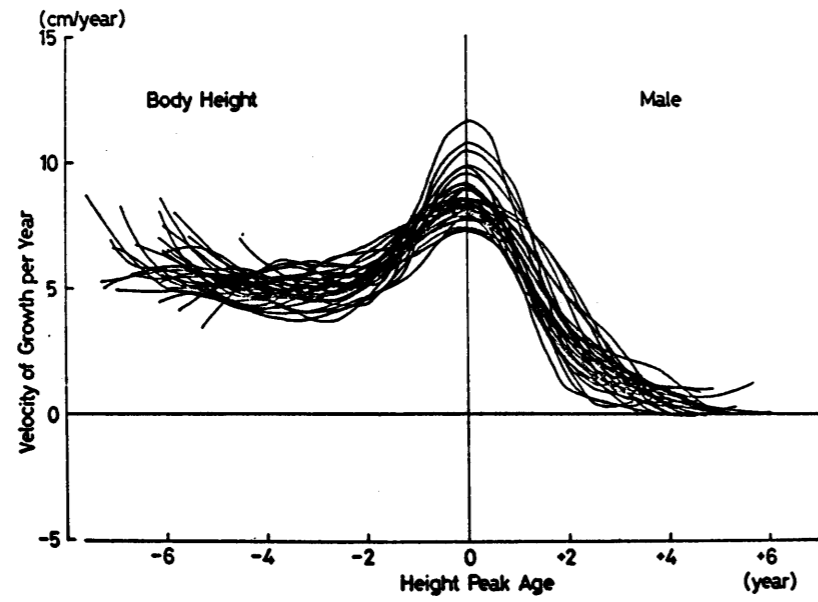


図27. ピーク時点を一致させた
身長発育速度曲線 (男子)

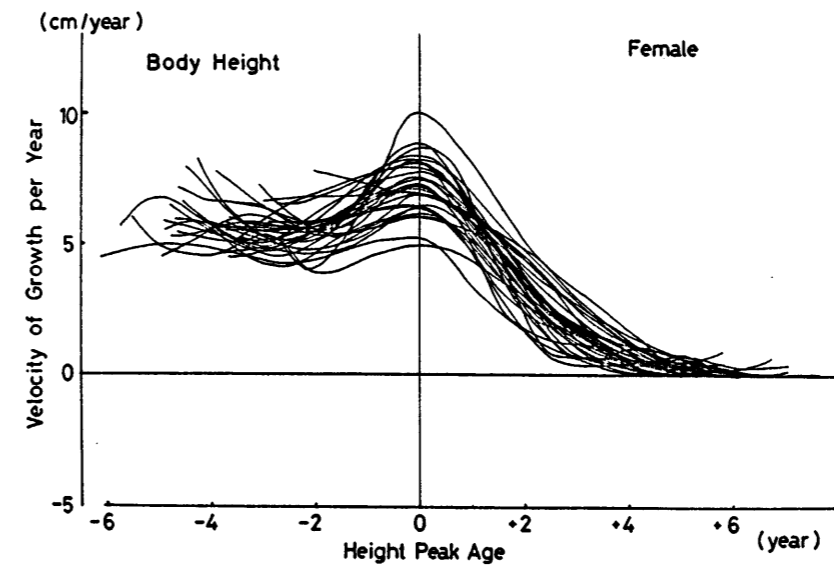


図28. ピーク時点を一致させた
身長発育速度曲線 (女子)

Sex	Male			Female		
Number	39			31		
Item Age (year)	Height Growth Velocity (cm/year)					
	Mean	±	S.D.	Mean	±	S.D.
- 4	4.84	±	0.64	-----		
- 3	4.94	±	0.69	5.48	±	0.68
- 2	5.39	±	0.60	5.38	±	0.70
- 1	7.02	±	0.64	6.30	±	0.74
Height Peak Age	8.53	±	0.95	7.25	±	1.00
+ 1	6.51	±	0.78	5.96	±	0.85
+ 2	3.03	±	0.94	3.55	±	1.00
+ 3	1.28	±	0.62	1.83	±	0.86
+ 4	-----			0.89	±	0.49

表12. 身長発育速度の平均値.

Sex	Male			Female		
Number	39			31		
Item Age (year)	Body Height (cm)					
	Mean	±	S.D.	Mean	±	S.D.
- 5	124.2	±	6.04	-----		
- 4	129.4	±	5.89	-----		
- 3	134.3	±	5.87	121.6	±	6.28
- 2	139.3	±	5.92	127.0	±	5.93
- 1	144.6	±	5.70	132.5	±	5.84
Height Peak Age	153.2	±	5.71	139.8	±	5.34
+ 1	162.2	±	5.36	147.0	±	4.70
+ 2	166.3	±	4.70	151.5	±	4.20
+ 3	168.4	±	4.41	153.8	±	3.81
+ 4	-----			154.9	±	3.60
+ 5	-----			155.4	±	3.47

表13. 身長発育速度ピーク時点に対する身長の平均値.

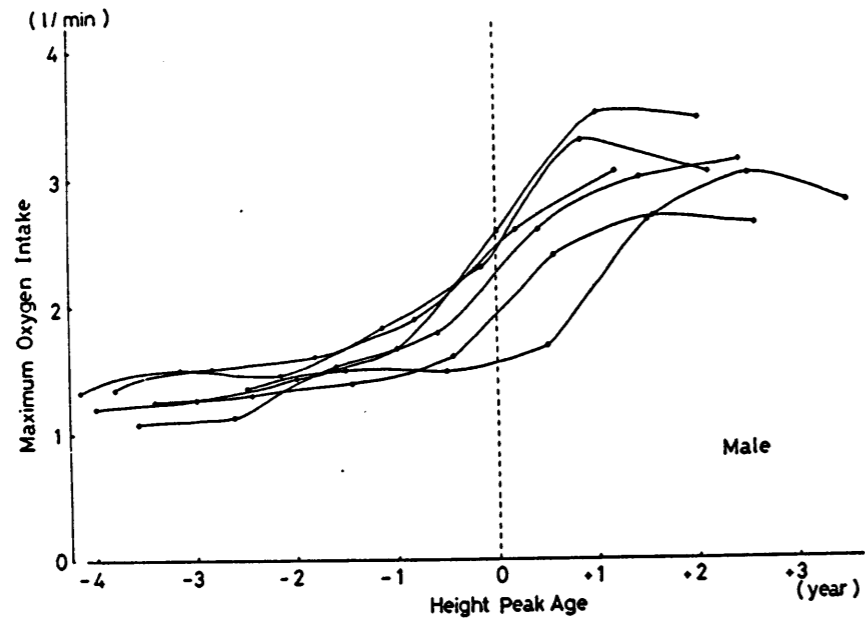


図29. 生理的年齢からみた最大酸素摂取量発達曲線。(刈谷グループ男子)

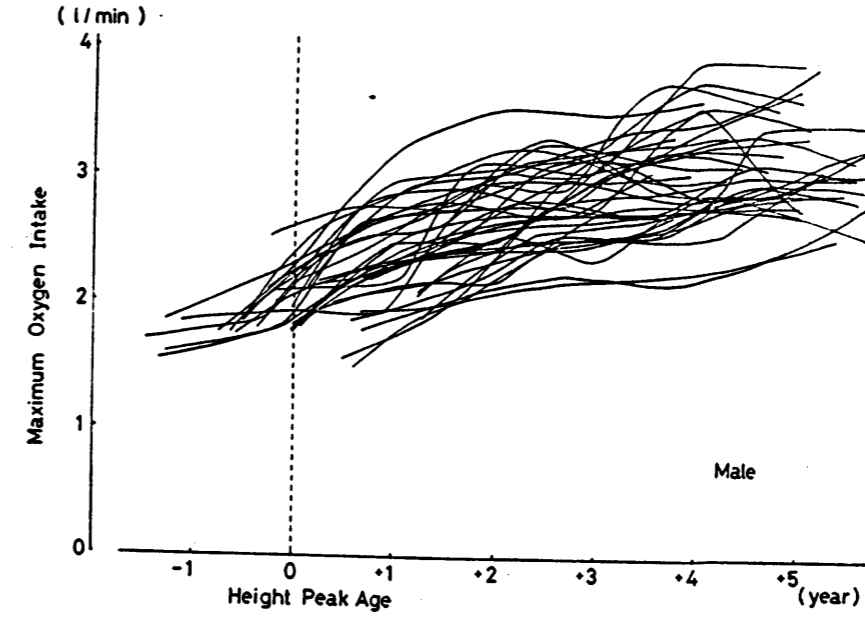


図30. 生理的年齢からみた最大酸素摂取量発達曲線。(附属グループ男子)

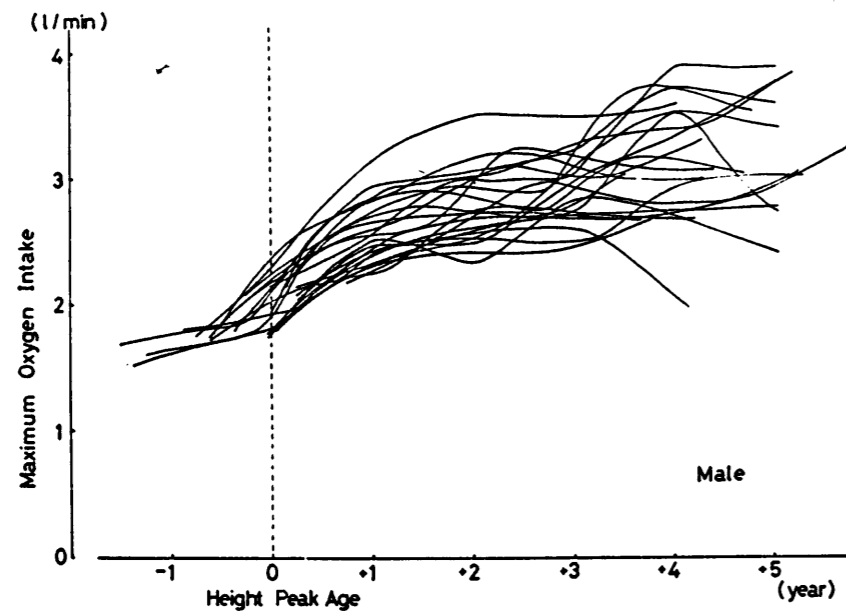


図31. 身長発育速度のピーク時期から最大酸素摂取量の急増がみられる例。(附属グループ男子)

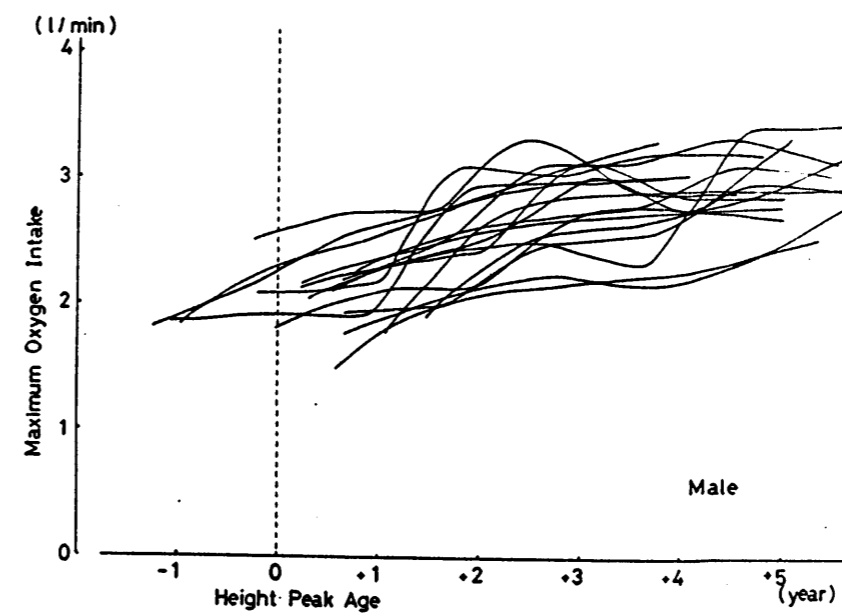


図32. 身長発育速度のピーク時期附近で最大酸素摂取量の急増がみられる例。(附属グループ男子)

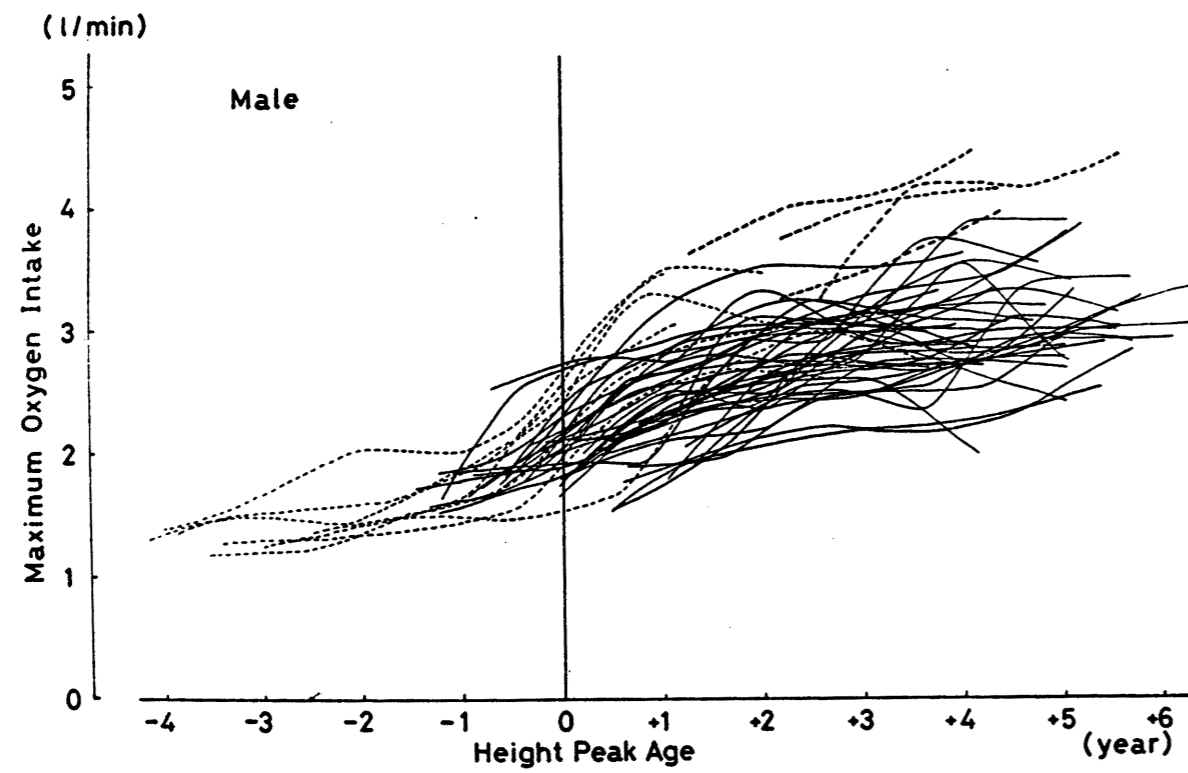


図33. 生理的年令からみた最大酸素摂取量
 発達曲線. (男子)

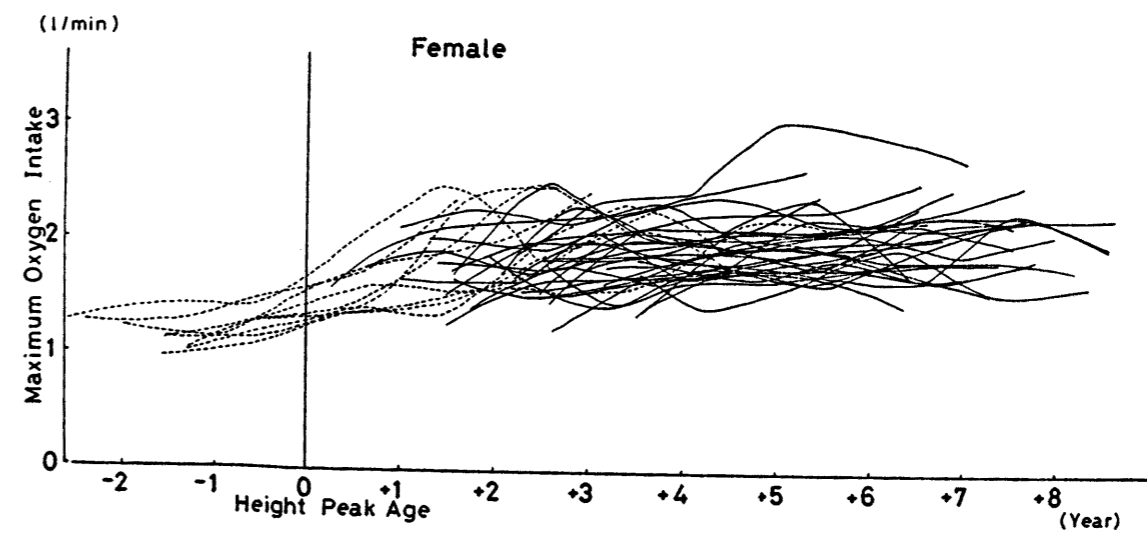


図34. 生理的年令からみた最大酸素摂取量
 発達曲線. (女子)

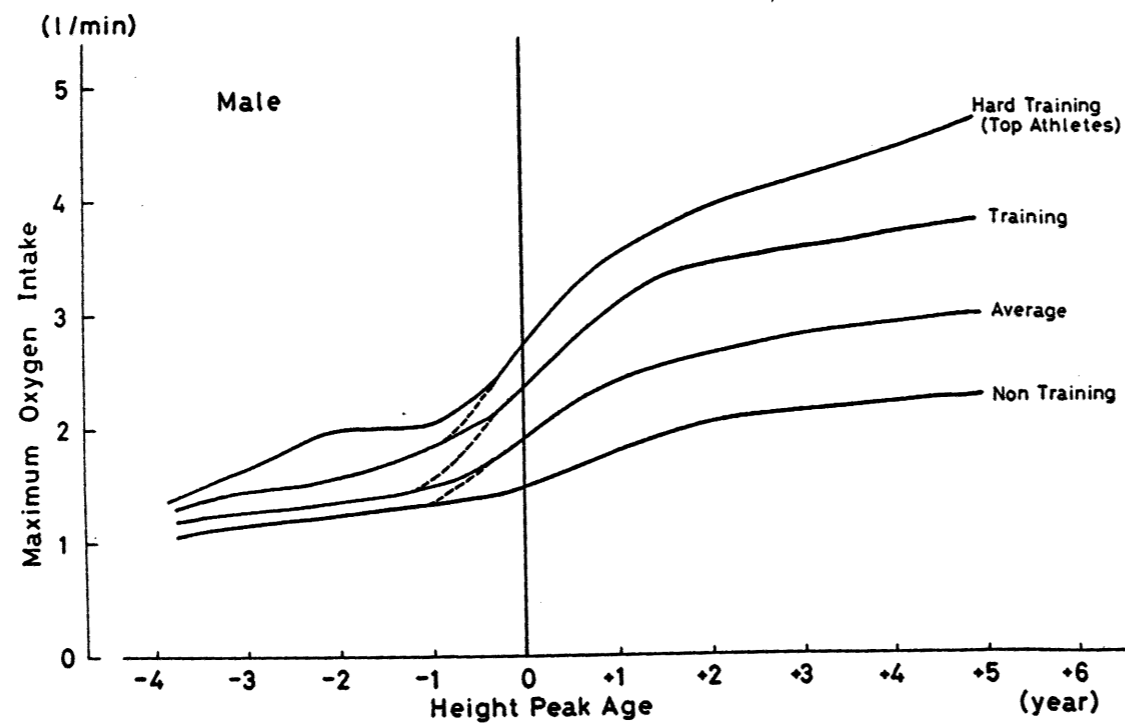


図35. 生理的年令からみた最大酸素摂取量
 発達曲線の模式図 (男子)

図35. ?

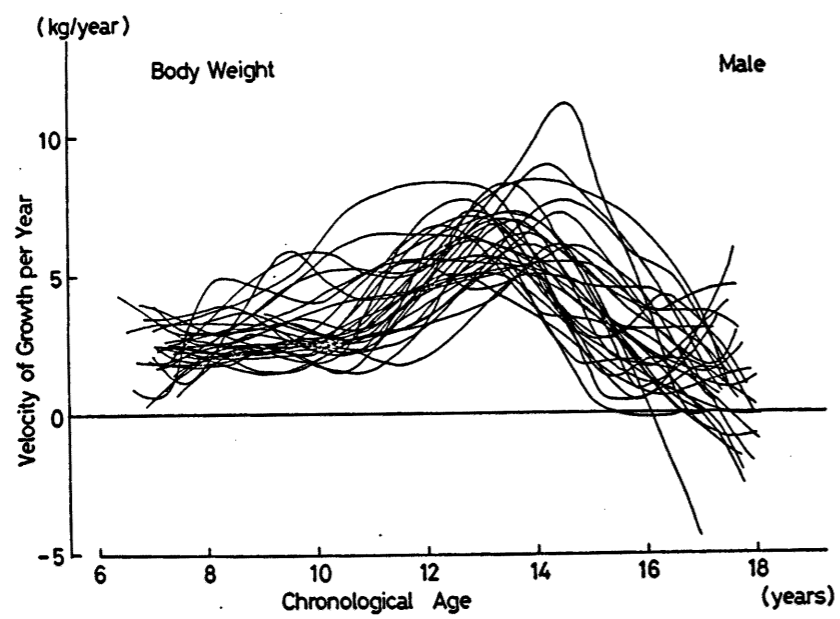


図36. 体重発育速度曲線。(男子)

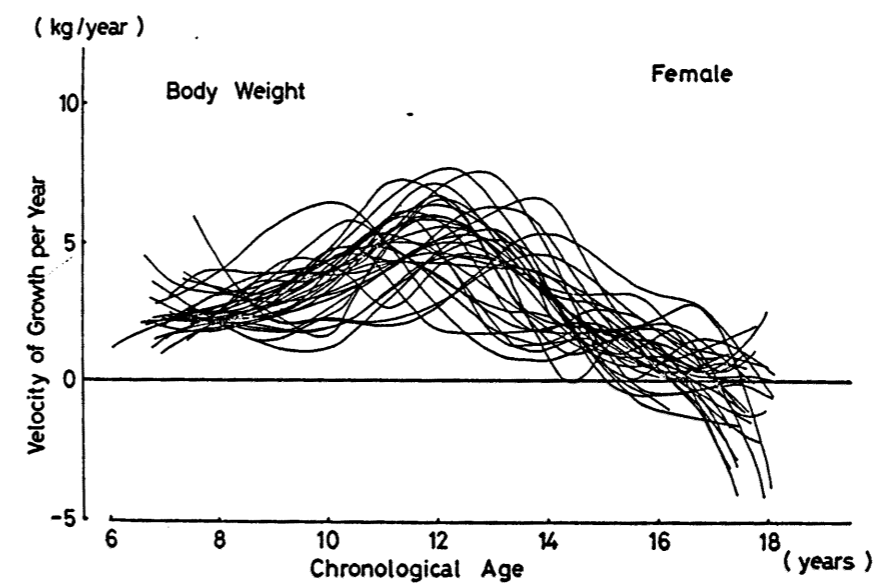


図37. 体重発育速度曲線。(女子)

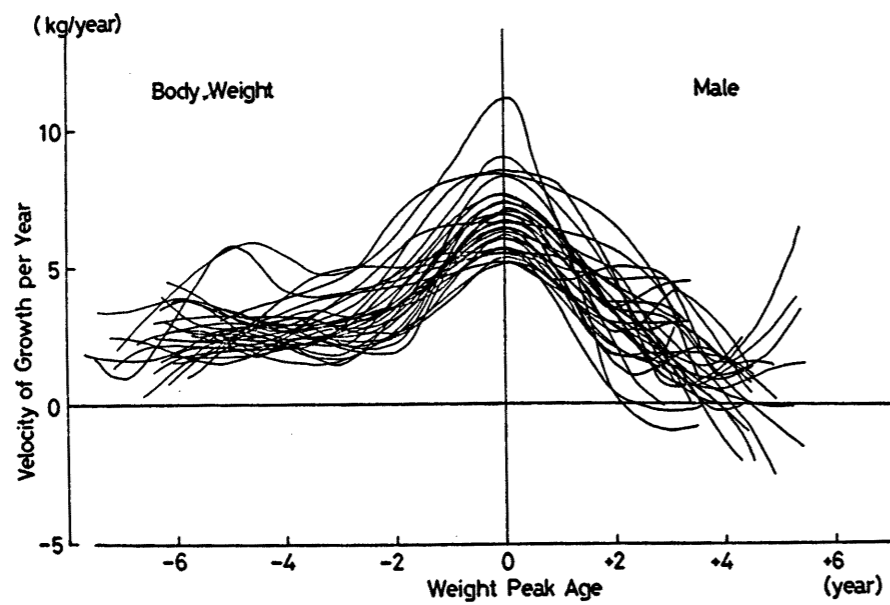


図38. ピーク時点を一致させた
体重発育速度曲線。(男子)

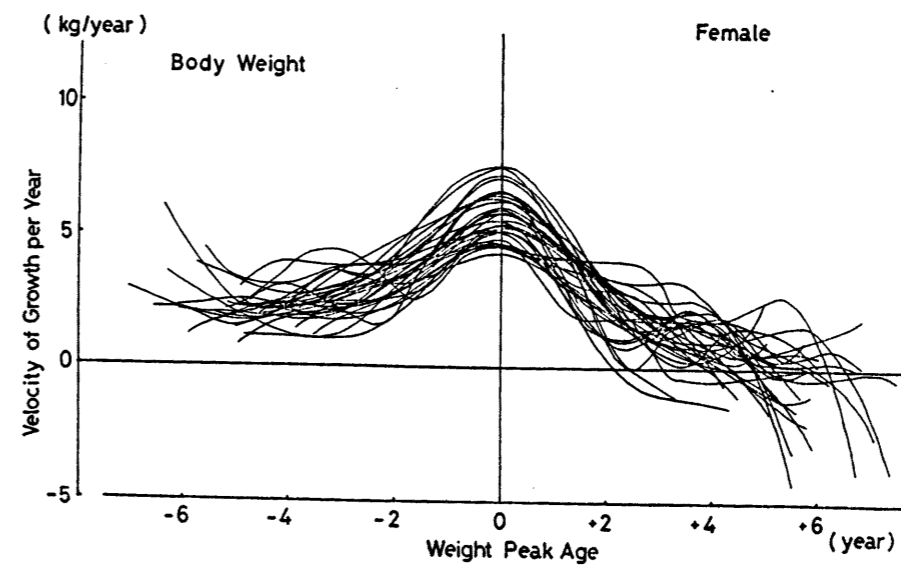


図39. ピーク時点を一致させた
体重発育速度曲線。(女子)

Sex	Male			Female		
Number	39			31		
Item Age (year)	Weight Growth Velocity (kg/year)					
	Mean	±	S.D.	Mean	±	S.D.
- 4	2.80	±	0.83	2.33	±	0.58
- 3	2.99	±	0.88	2.75	±	0.70
- 2	3.83	±	1.12	3.35	±	0.68
- 1	5.56	±	1.10	4.78	±	0.75
Weight Peak Age	6.69	±	1.36	5.64	±	0.87
+ 1	5.22	±	1.02	4.49	±	0.75
+ 2	3.12	±	1.30	2.50	±	0.93
+ 3	1.98	±	1.62	1.54	±	0.99
+ 4		-----		1.08	±	0.93

表14. 体重発育速度の平均値.

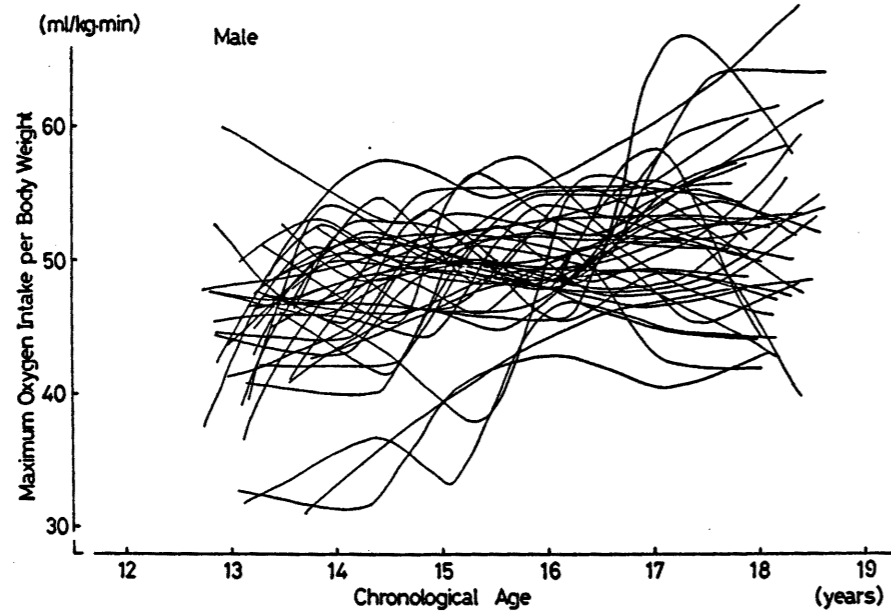


図40. 体重あたり最大酸素摂取量の発達曲線.
(男子)

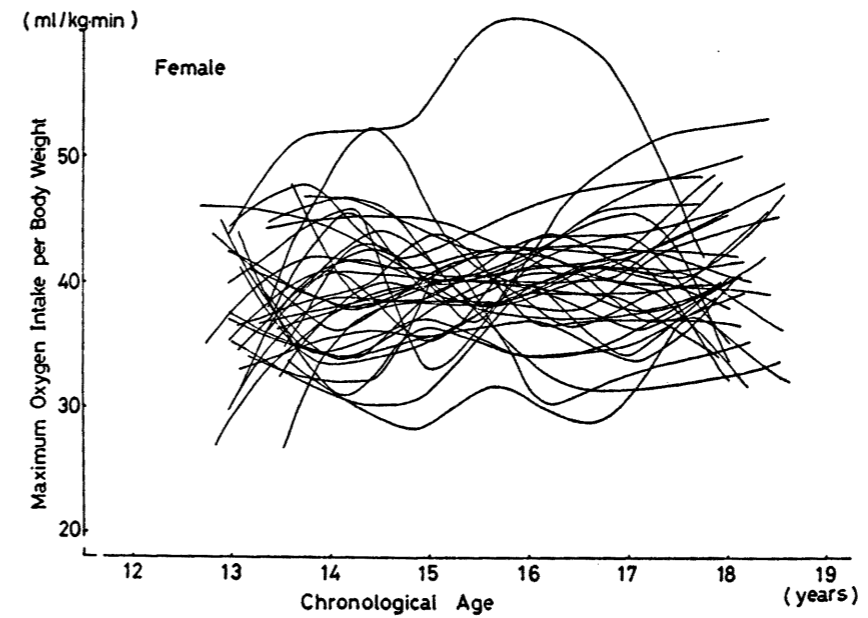


図41. 体重あたり最大酸素摂取量の発達曲線.
(女子)

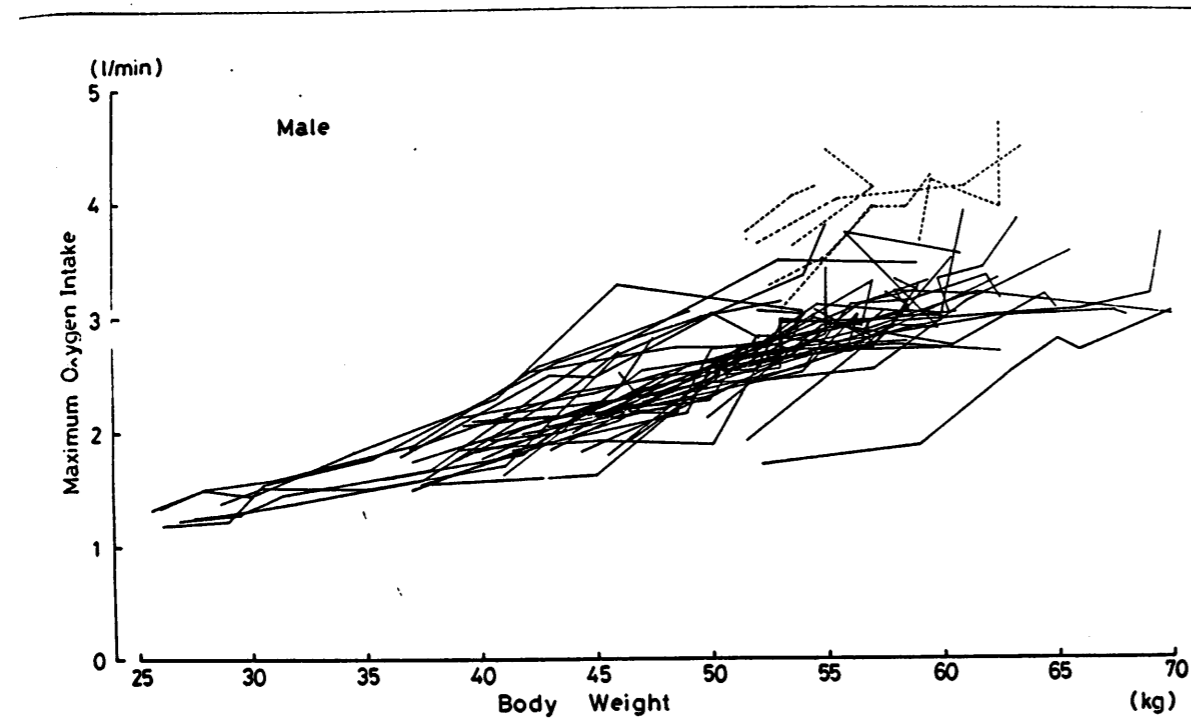


図42. 体重発育と最大酸素摂取量の発達。(男子).
 (黒線: 刈谷グループ及び附属グループ)
 (破線: 陸上選手グループ)

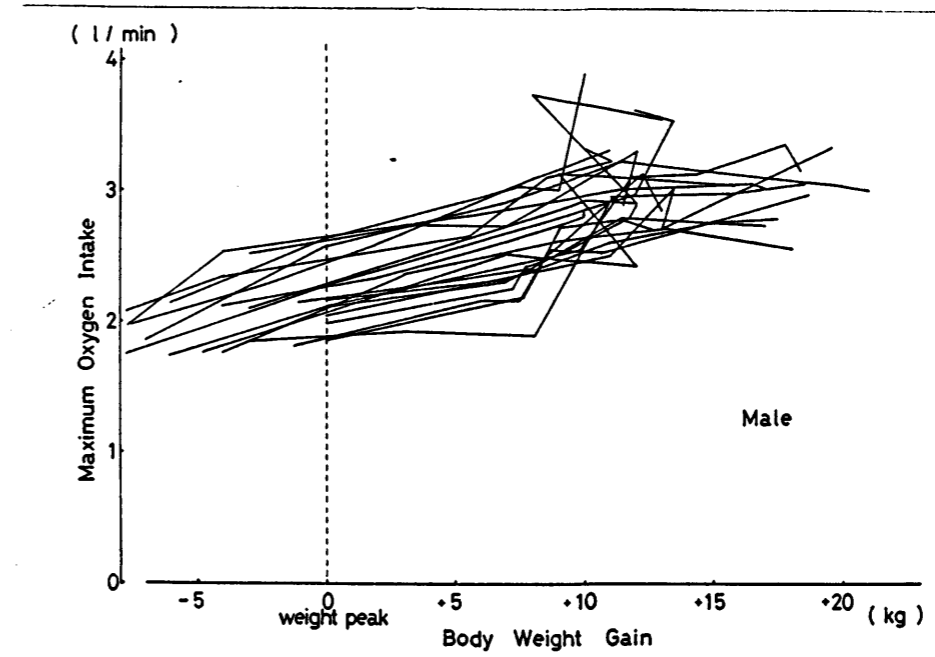


図43. 体重発育速度のピーク時点をはさんで、
 最大酸素摂取量が滑らかに増大するタイプ。

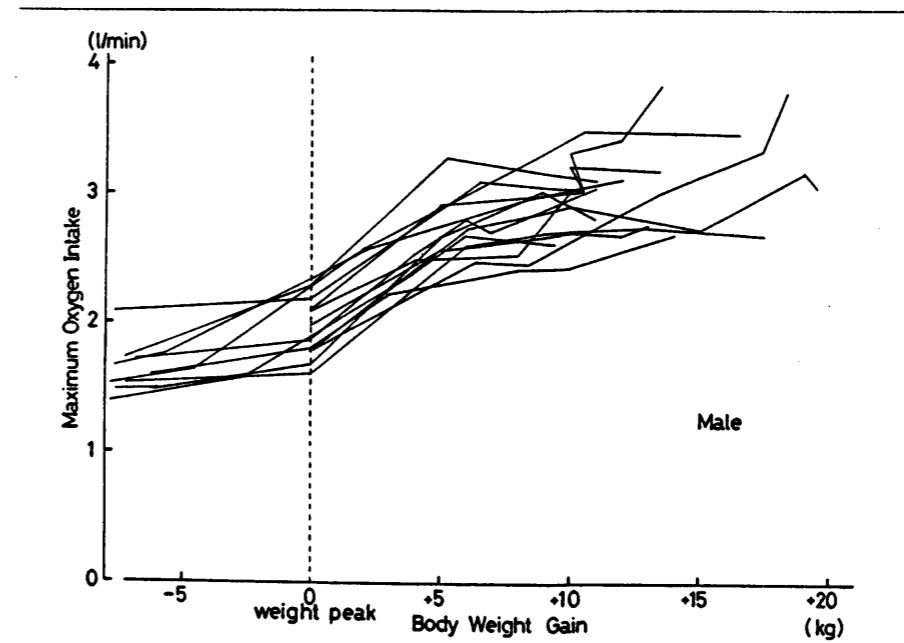


図44. 体重発育速度のピーク時点、後、
 最大酸素摂取量が急増するタイプ。

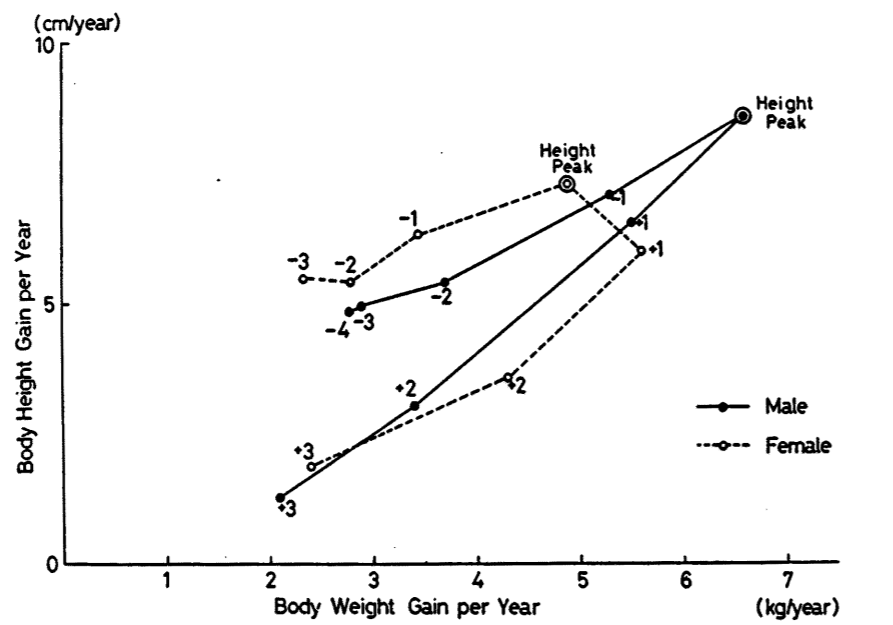


図45. 身長発育速度のピーク時点を基準としてみた、身長発育速度に対する体重発育速度の年次的変化。

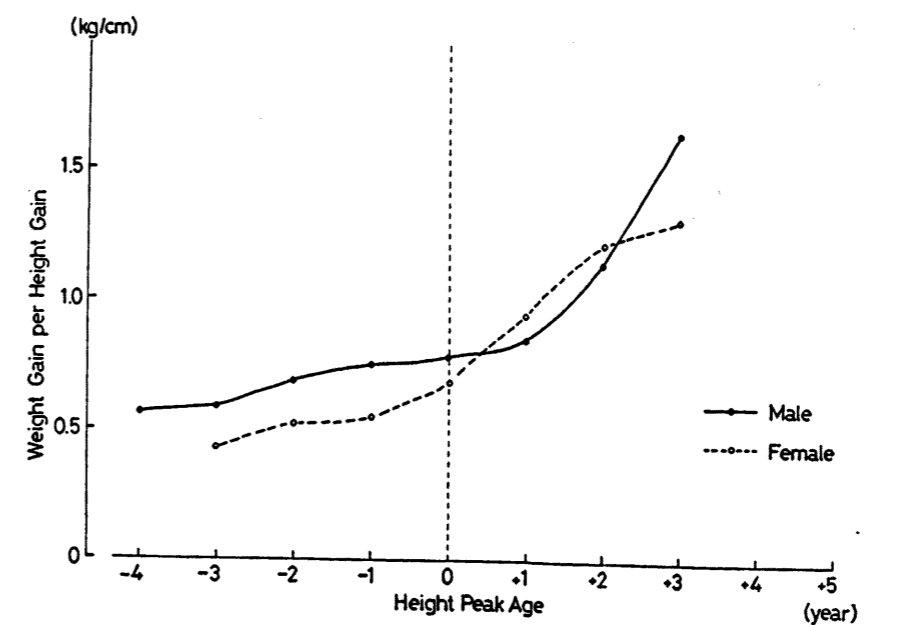


図46. 身長発育速度のピーク時点を基準としてみた、身長1cmの発育に対する体重発育量の年次的変化

Sex	Male	Female
Number	39	31
Item Age (year)	Weight Growth Velocity per Height Growth Velocity. (kg/cm)	
- 4	0.58	-----
- 3	0.59	0.43
- 2	0.69	0.52
- 1	0.75	0.55
Height Peak Age	0.77	0.68
+ 1	0.84	0.94
+ 2	1.12	1.21
+ 3	1.64	1.31
+ 4	-----	1.63

表15. 身長発育速度に対する体重発育速度.

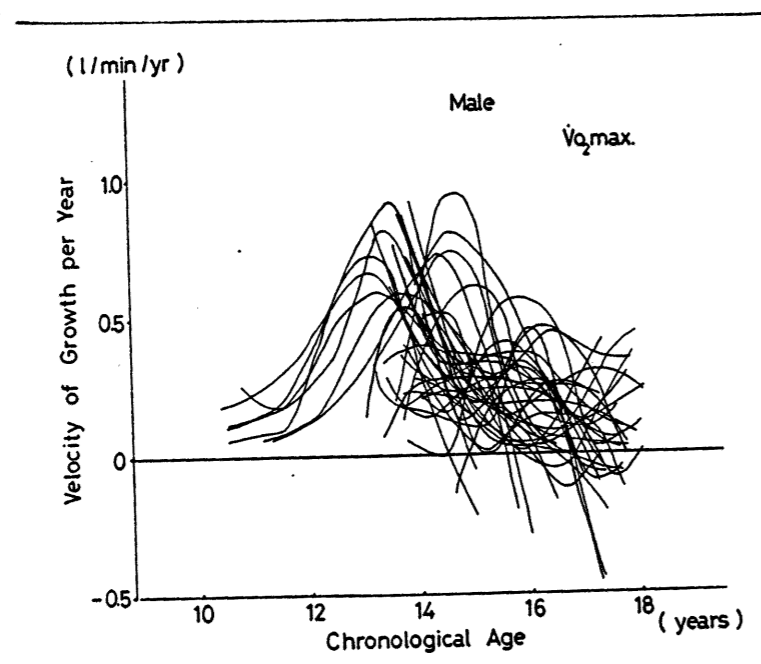


図47、最大酸素摂取量発達速度曲線、
(男子)

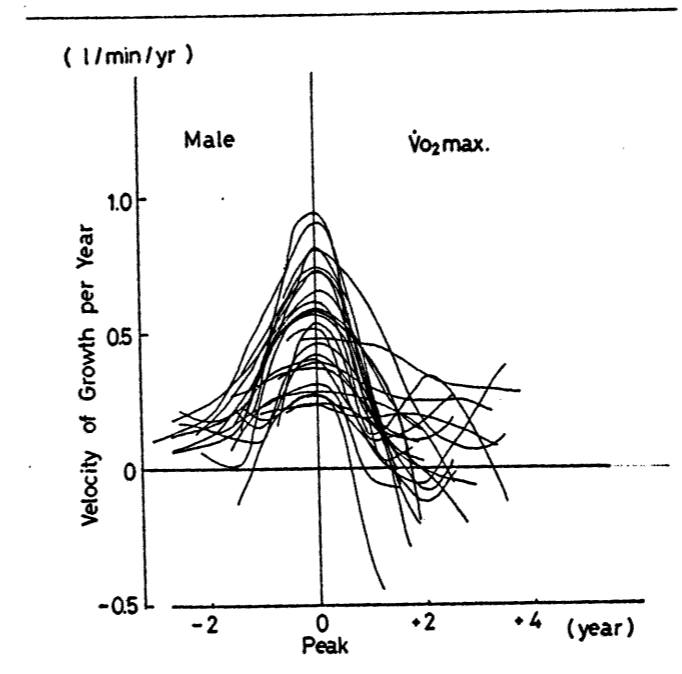


図48、ピーク時点を一致させた
最大酸素摂取量発達速度曲線、
(男子)

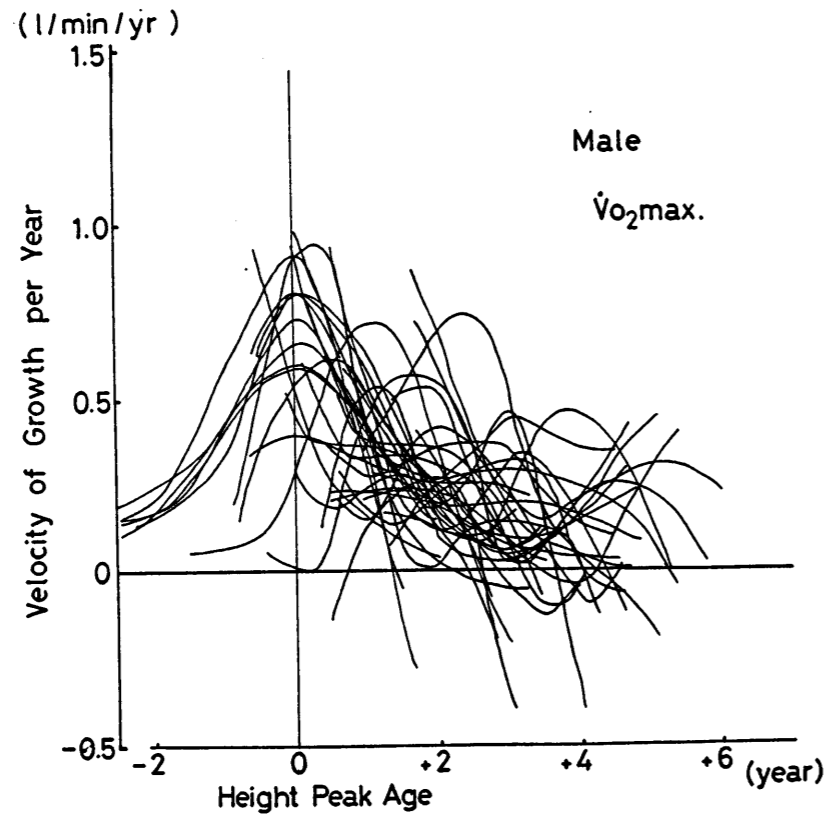


図49. 身長発育速度のピーク時点に対する
最大酸素摂取量発達速度曲線
(男子)

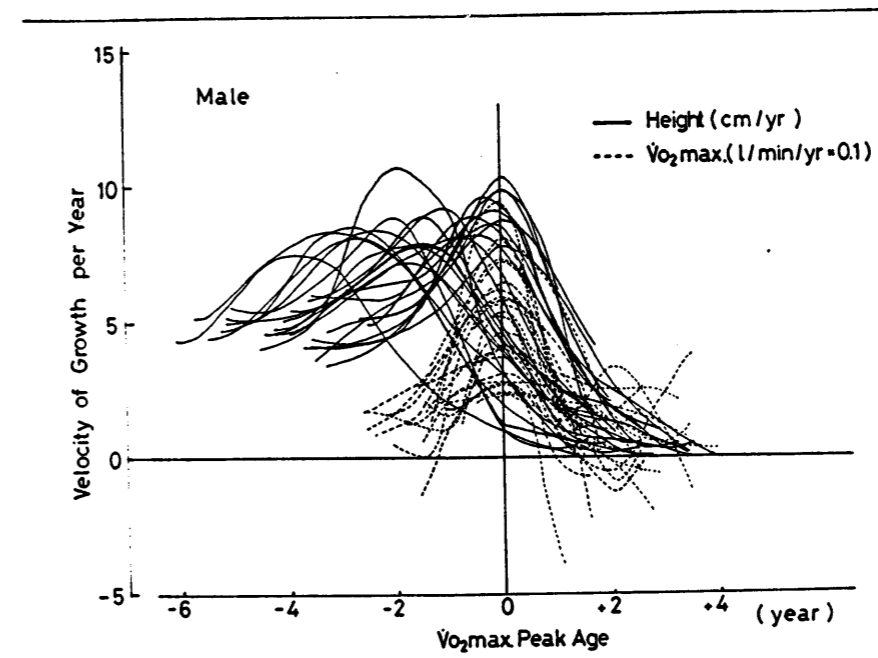


図50. 最大酸素摂取量発達速度のピーク時点、
を一致させたときの、身長発育速度曲線。
(男子)

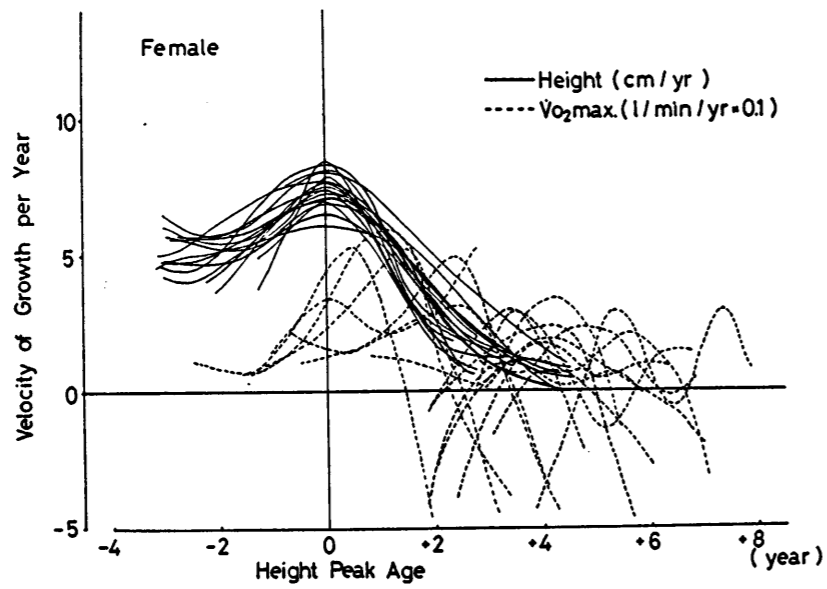


図51. 身長発育速度のピーク時点に対する
最大酸素摂取量発達速度曲線。
(ピーク、極大値のみをみたす例.)
(附属グループ女子)

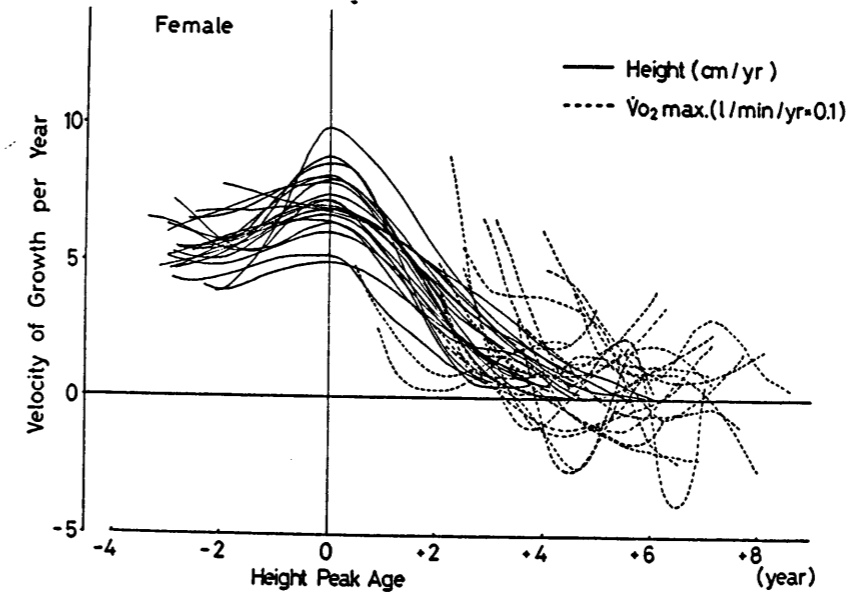


図52. 身長発育速度のピーク時点に対する
最大酸素摂取量発達速度曲線。
(ピークが測定期間前にあったと思われる例.)
(附属グループ女子)

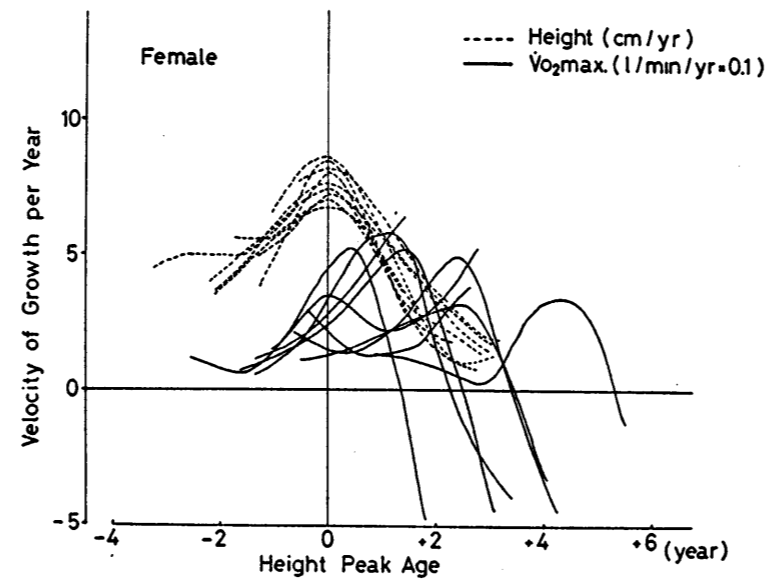


図53. 身長発育速度のピーク時点に対する
最大酸素摂取量発達速度曲線。
(刈谷グループ女子)

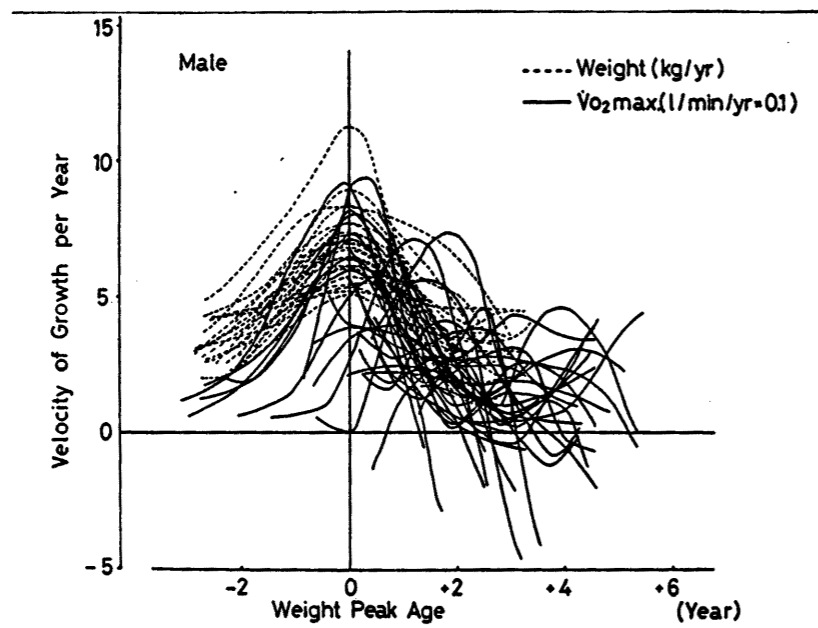


図54. 体重発育速度のピーク時点に対する
最大酸素摂取量発達速度曲線。
(男子)

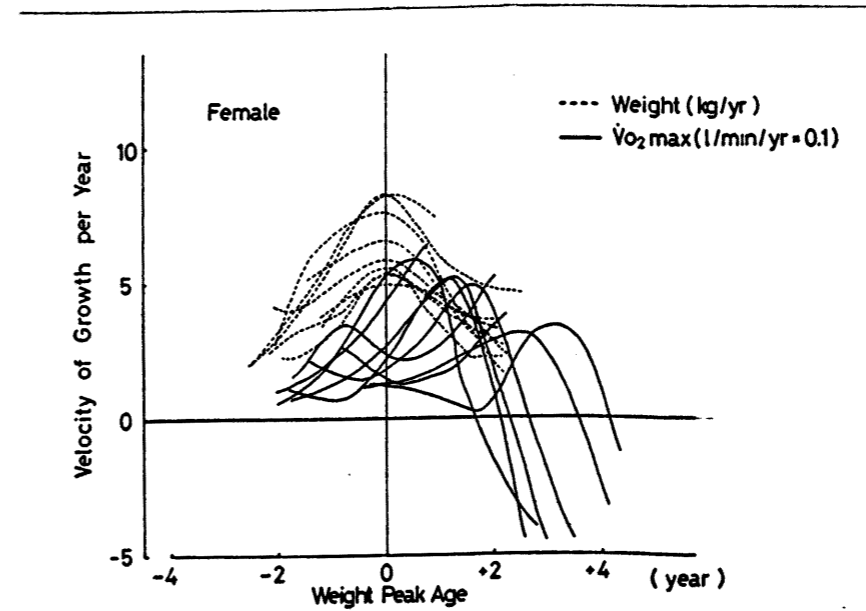


図55. 体重発育速度のピーク時点に対する
最大酸素摂取量発達速度曲線。
(女子)

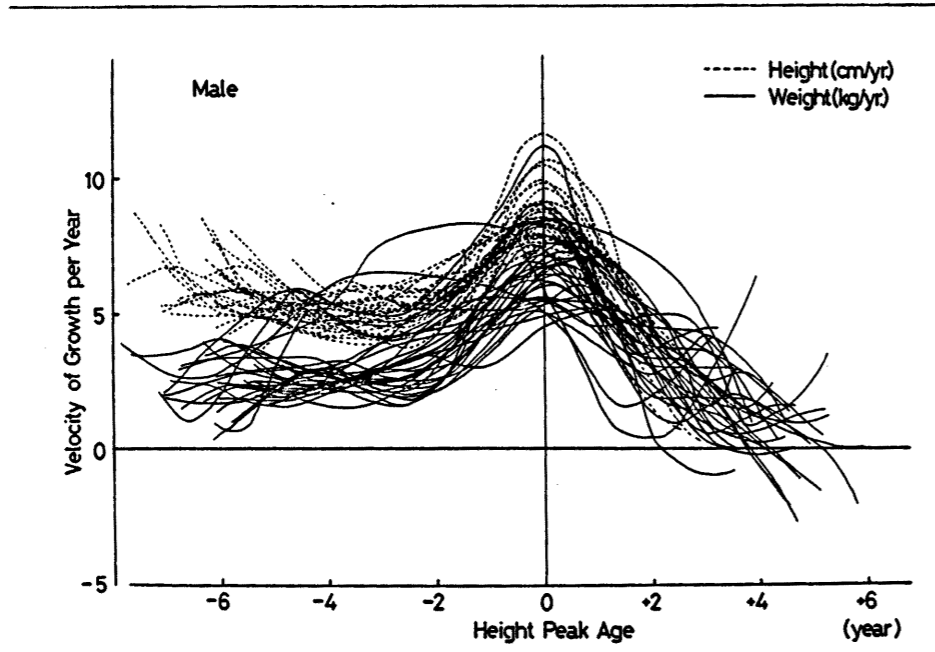


図56. 身長発育速度のピーク時点に対する
体重発育速度曲線. (男子)

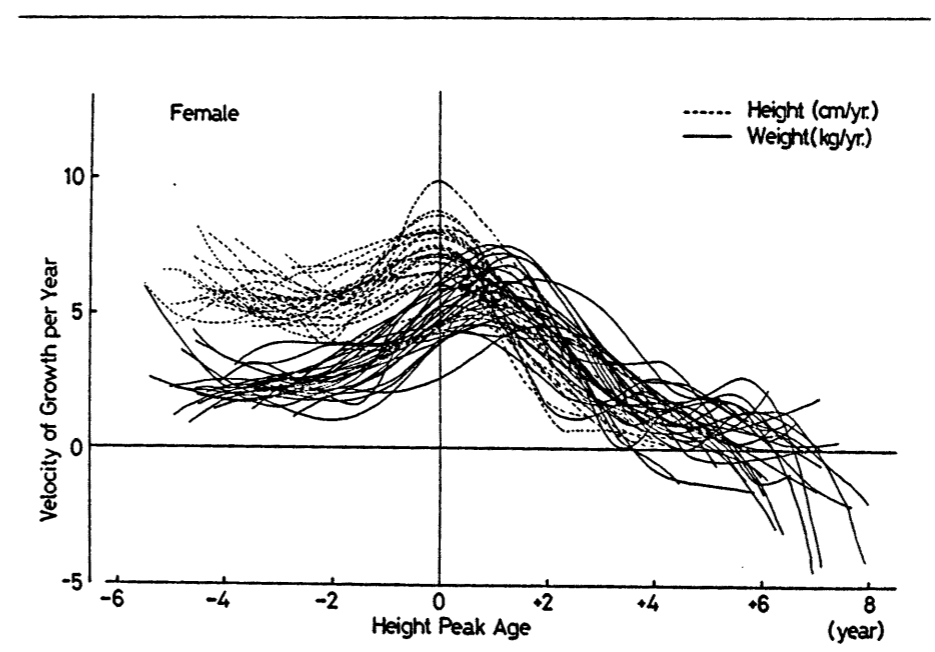


図57. 身長発育速度のピーク時点に対する
体重発育速度曲線. (女子)

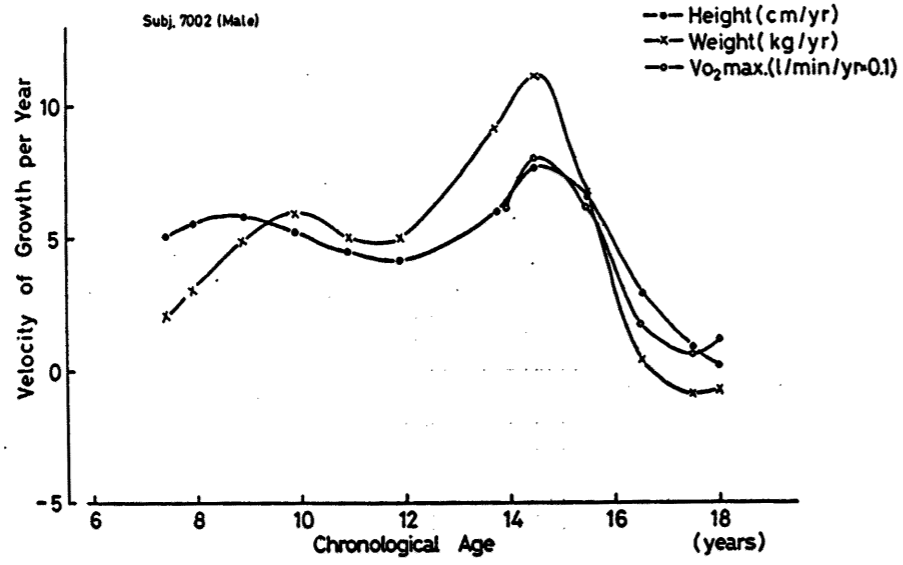


図58. 才1型
(身長・体重・最大酸素摂取量のピーク一致)

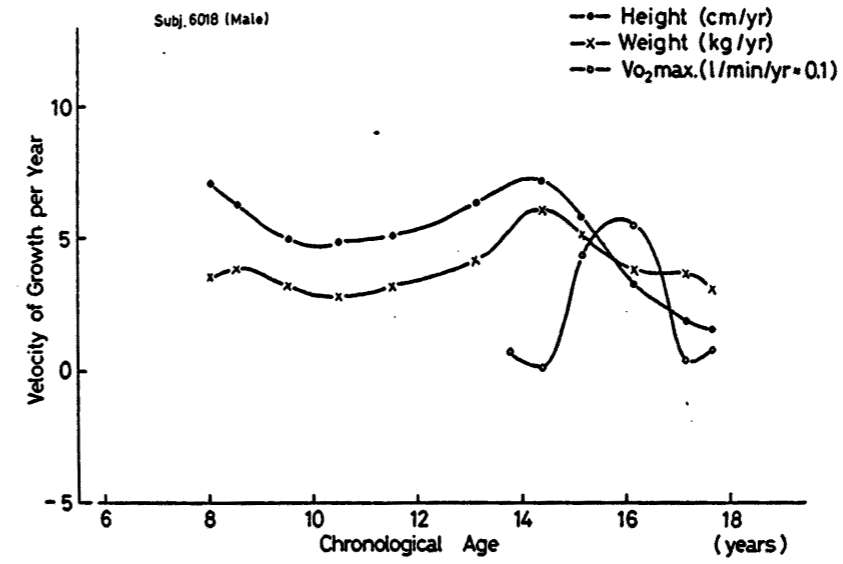


図59. 才2型.
(身長・体重 — 最大酸素摂取量)

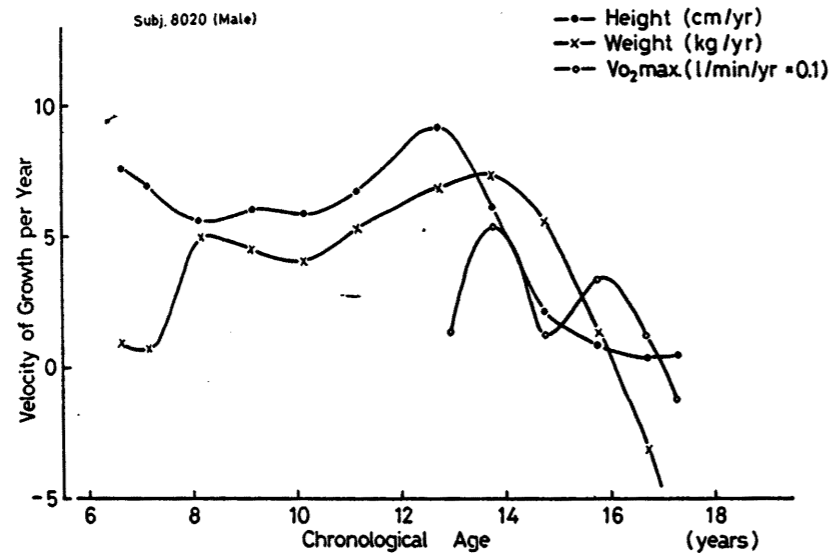


図60. 才3型.
(身長 — 体重・最大酸素摂取量)

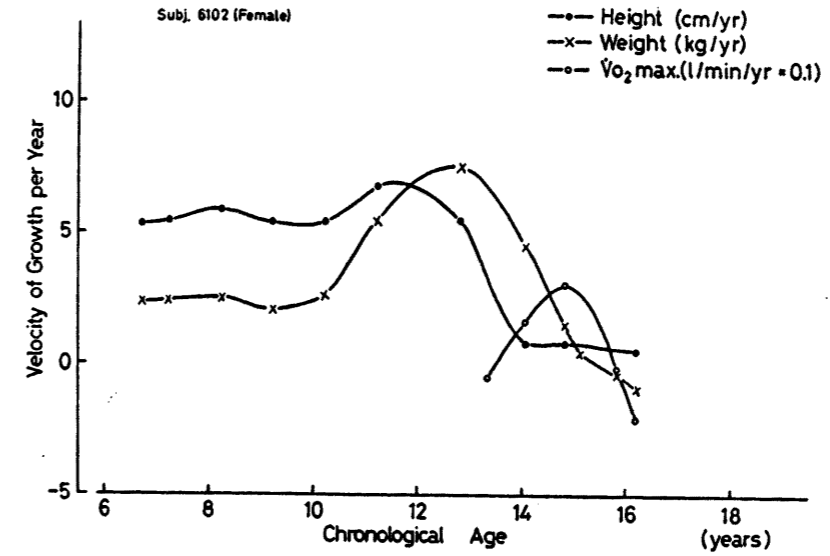


図61. 才4型.
(身長 — 体重 — 最大酸素摂取量)

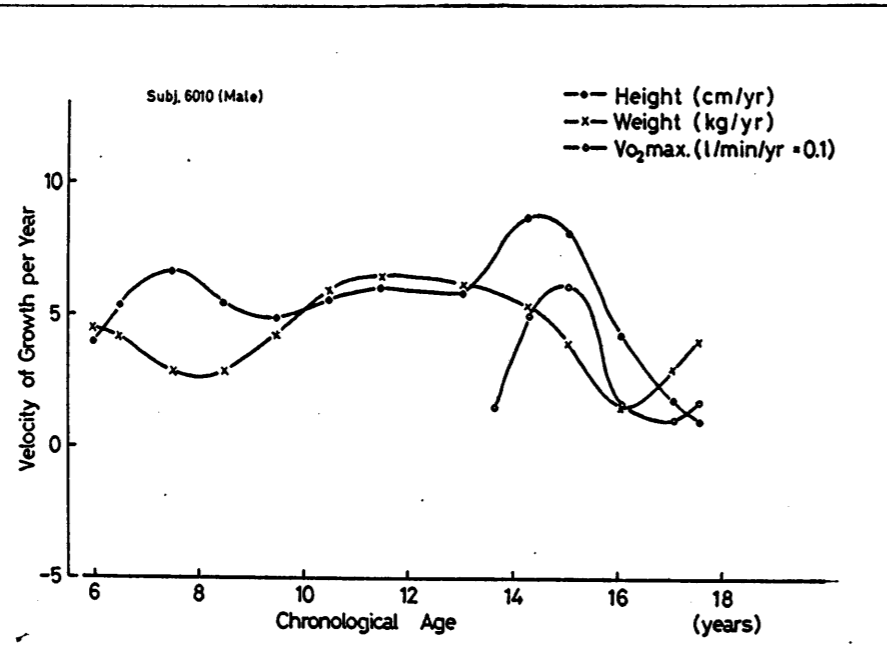


圖62. 才5型.
(体重 — 身長 · 最大酸素攝取量)

		1 Type	2 Type	3 Type	4 Type	5 Type	6 Type
Male N=46	Fuzoku Group	15	11	6	4	3	0
	Kariya Group	4	2	0	0	0	1
	Total	19 (41.3 %)	13 (28.3 %)	6 (13.0 %)	4 (8.7 %)	3 (6.5 %)	1 (2.2 %)
Female N=41	Fuzoku Group	1	6	5	19	0	1
	Kariya Group	0	2	0	6	1	0
	Total	1 (2.4 %)	8 (19.5 %)	5 (12.2 %)	25 (61.0 %)	1 (2.4 %)	1 (2.4 %)

表16. 身長, 体重, 最大酸素摂取量の発育発達パターン別例数.

カ1型 : 身長, 体重, 最大酸素摂取量のピーク時点一致.

カ2型 : 身長・体重 — 最大酸素摂取量.

カ3型 : 身長 — 体重・最大酸素摂取量.

カ4型 : 身長 — 体重 — 最大酸素摂取量.

カ5型 : 体重 — 身長・最大酸素摂取量.

カ6型 : その他

		Junior High School 1	2	3	High School 1	2	3
		Male	Number	14	43	43	42
Mean (sec)	410.4		388.7	377.1	357.4	353.8	364.0
S.D. (sec)	22.9		27.2	25.1	25.2	27.7	30.0
Female	Number	24	35	37	33	33	30
	Mean (sec)	273.7	286.9	285.0	273.9	271.4	282.4
	S.D. (sec)	14.5	19.1	19.9	16.4	13.3	15.5

Male:1500M Running. Female:1000M Running.

表17. 持久走記録の推移。(男子1500m, 女子1000m)

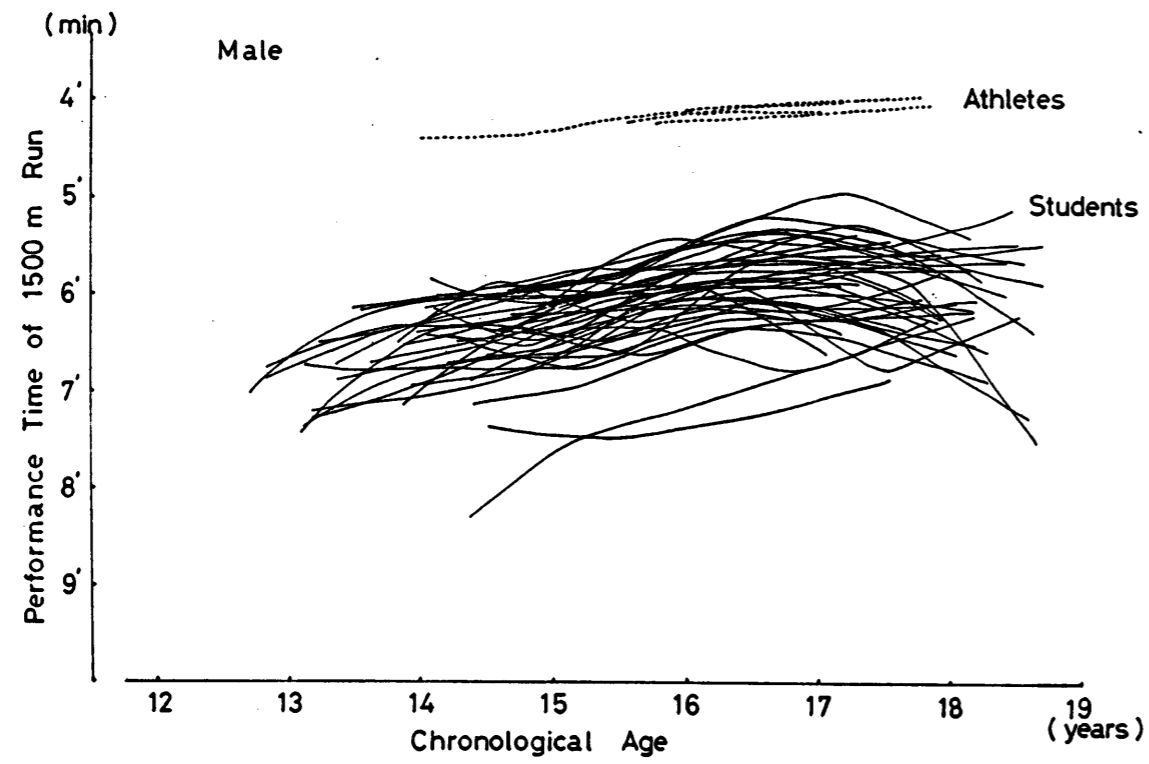


圖63. 1500m走 到達曲線 (男子)

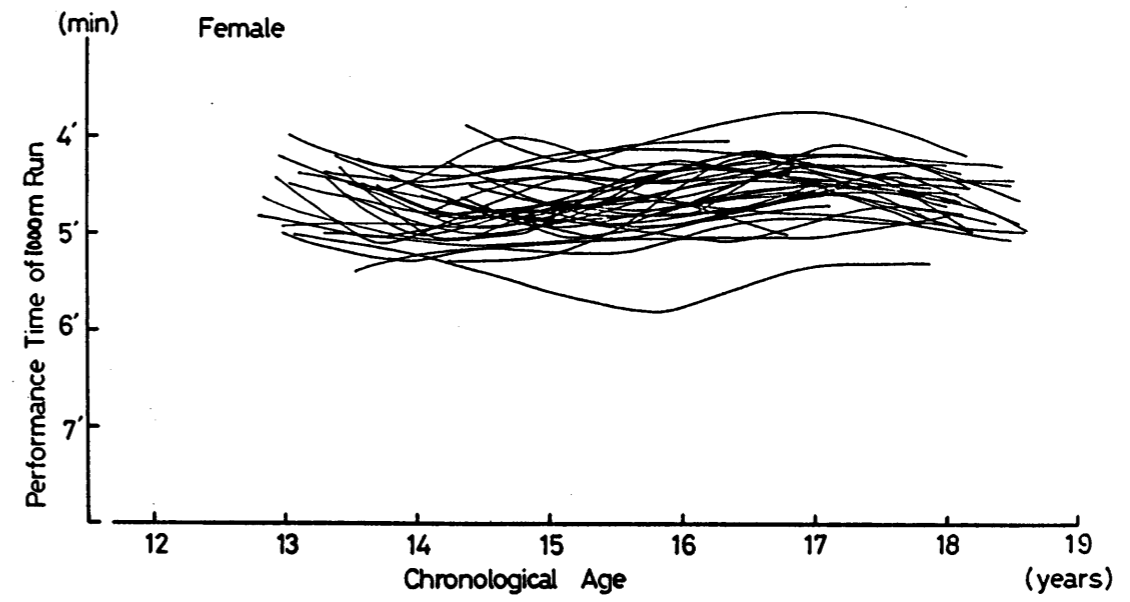


圖64. 1000m走 到達曲線 (女子)

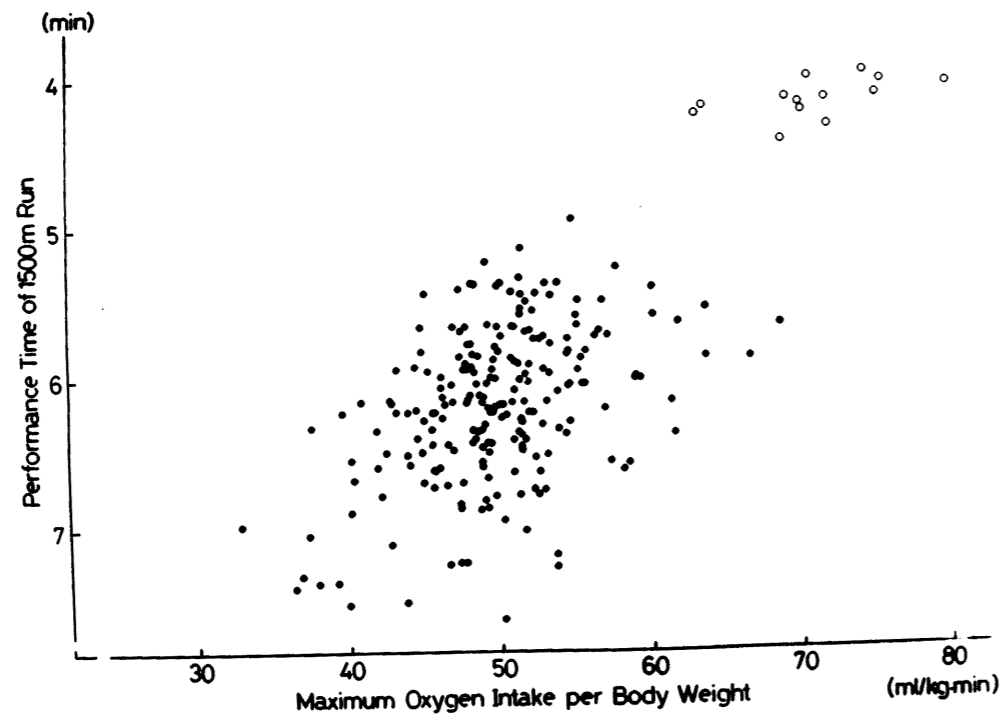


図65. 体重あたり最大酸素摂取量と1500m走記録との関係。(男子)

(選手: ○)
(一般生徒: ●)

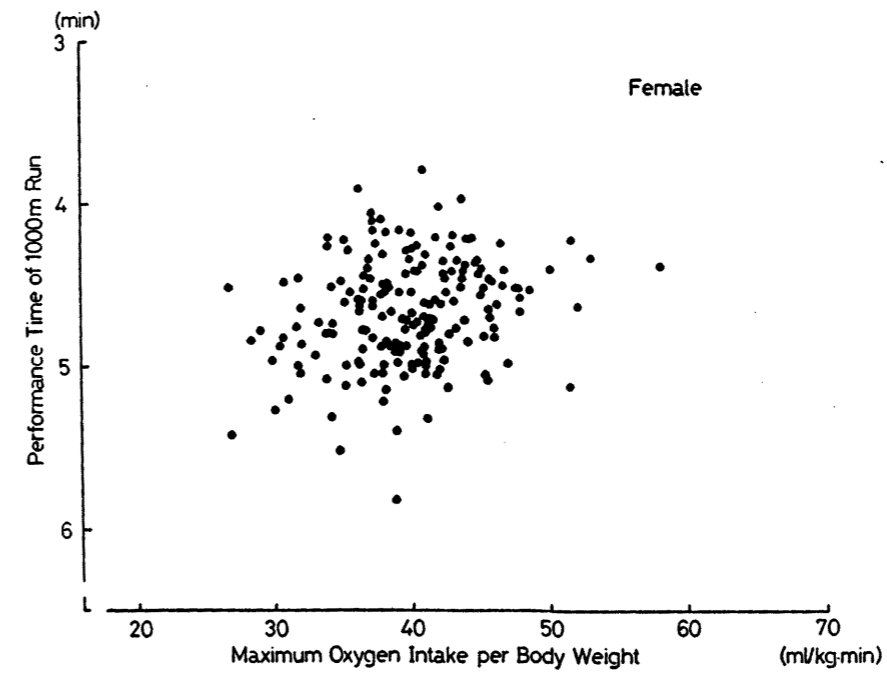


図66. 体重あたり最大酸素摂取量と1000m走記録との関係(女子)

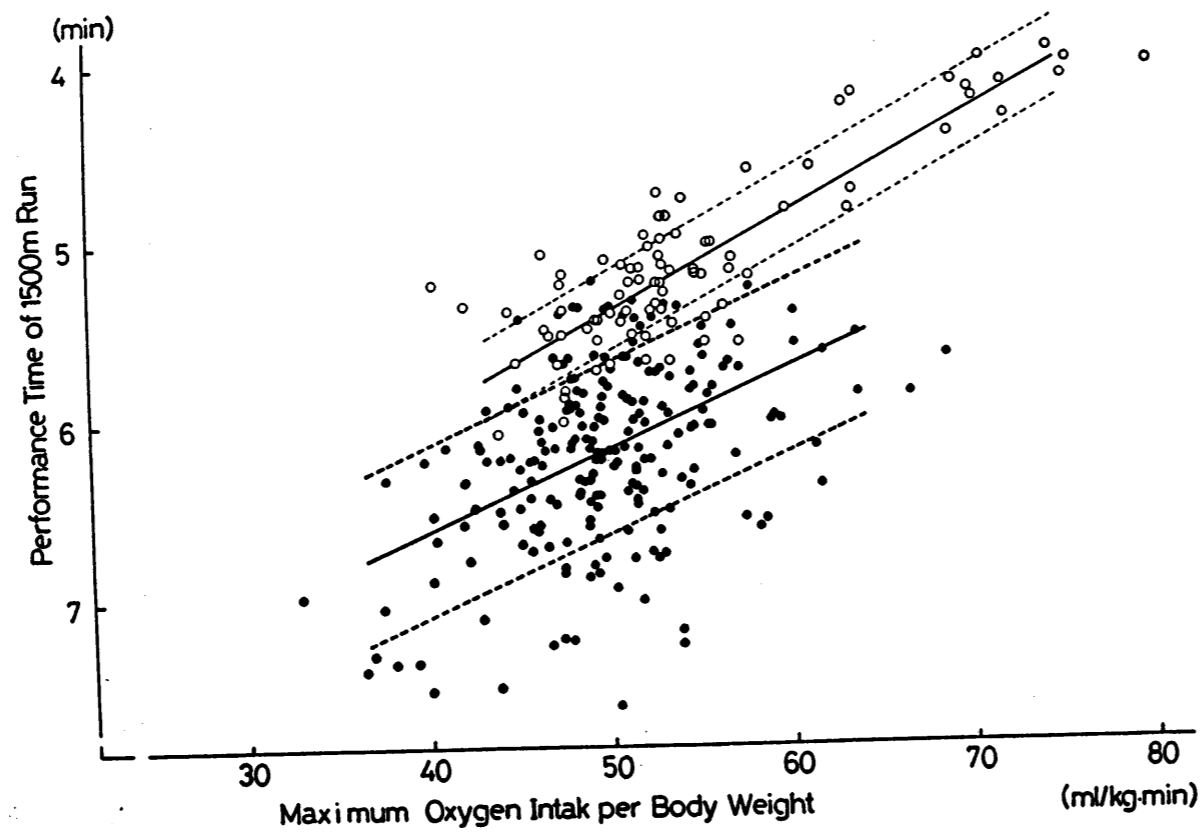


図 67. 体重あたり最大酸素摂取量と
1500m走記録との関係、
トレーニング群(○)と、一般生徒(●)との比較。

Items \ Age	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 - 72
Number of Subjects	45	27	45	15	9	1
Body Height (cm)	167.7 ± 5.7	165.3 ± 4.5	164.8 ± 5.4	163.6 ± 2.9	161.8 ± 5.8	148.2
Body Weight (kg)	59.9 ± 8.75	60.8 ± 6.59	61.3 ± 10.52	60.9 ± 6.45	60.1 ± 6.00	51.5
Max. Ventilation (STPD) (l/min)	83.8 ± 21.6	79.3 ± 20.4	65.5 ± 14.1	64.4 ± 10.4	53.9 ± 17.9	45.7
Max. Oxygen Intake (l/min)	2.57 ± 0.62	2.45 ± 0.44	2.19 ± 0.49	2.07 ± 0.38	1.74 ± 0.46	1.39
Max. Oxygen Intake per Body Weight (ml/kg.min)	42.7 ± 9.09	40.6 ± 6.43	36.3 ± 7.87	34.0 ± 5.06	28.8 ± 6.21	27.1
Max. Heart Rate (beats/min)	188.3 ± 11.8	180.3 ± 9.10	176.0 ± 10.8	174.8 ± 7.5	160.2 ± 10.5	161
Max. Respiratory Rate (freq./min)	49.6 ± 11.9	45.8 ± 9.8	39.4 ± 6.8	41.3 ± 8.9	37.9 ± 8.2	32

(Mean ± S.D.)

Results for non-athletic healthy male

表 18. 一般健康成人男子の最大酸素摂取量測定結果.

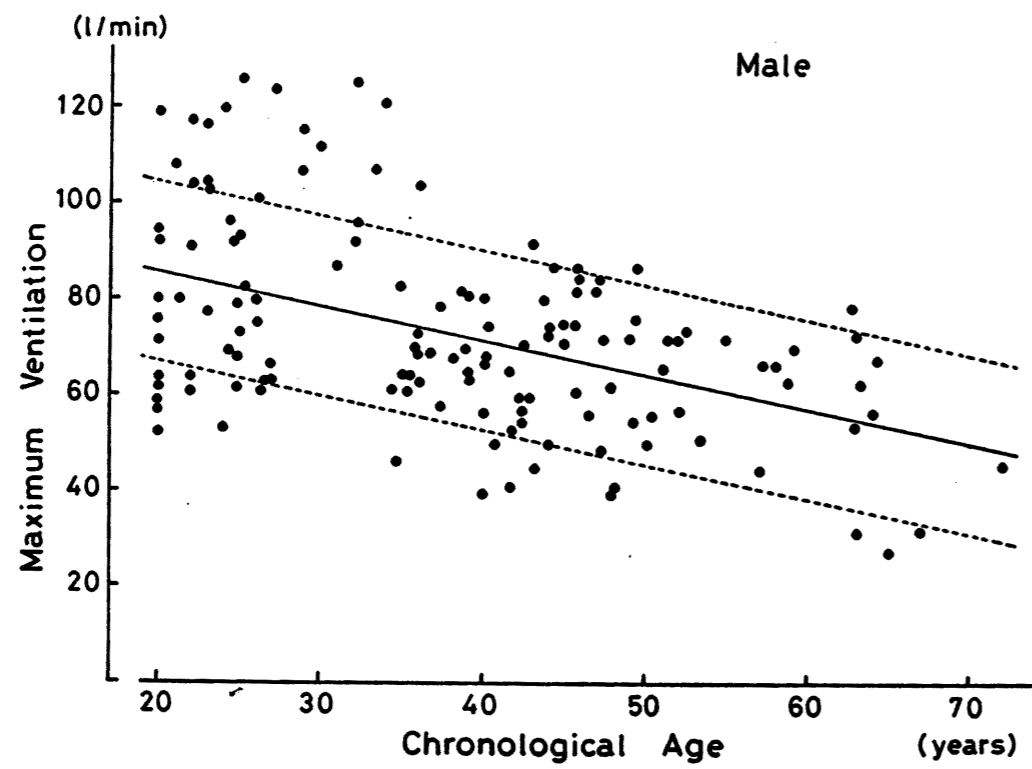


図 68. 一般健康成人男子の最大換気量.

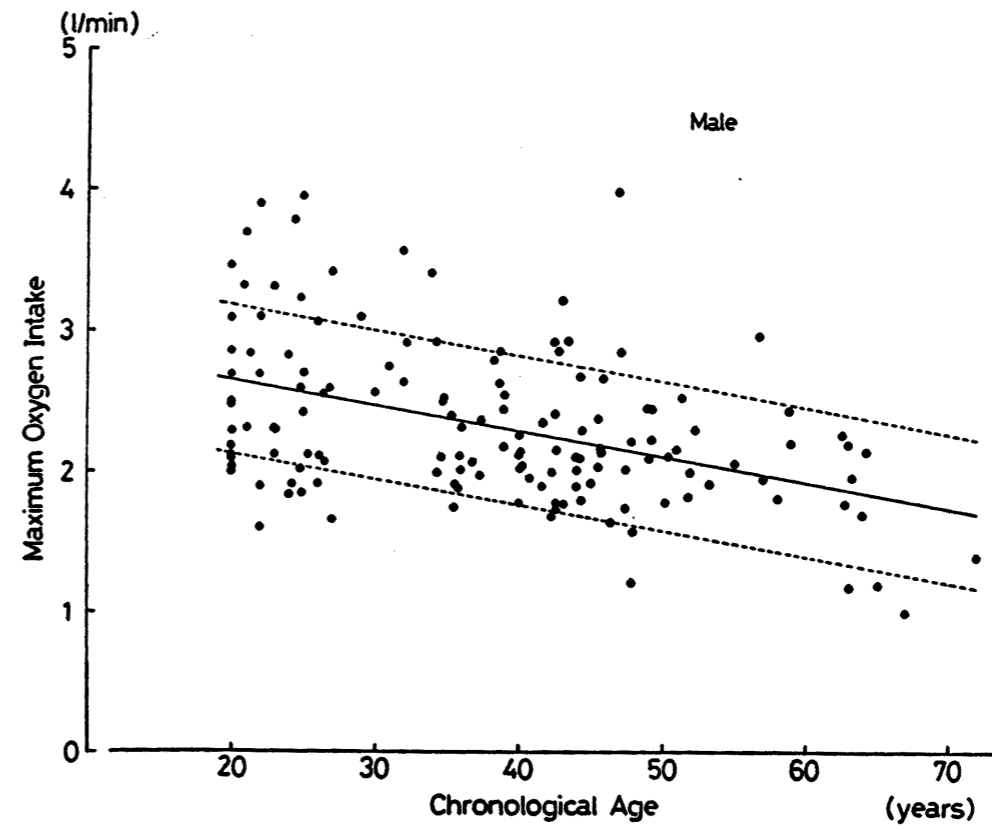


図 69. 一般健康成人男子の最大酸素摂取量.

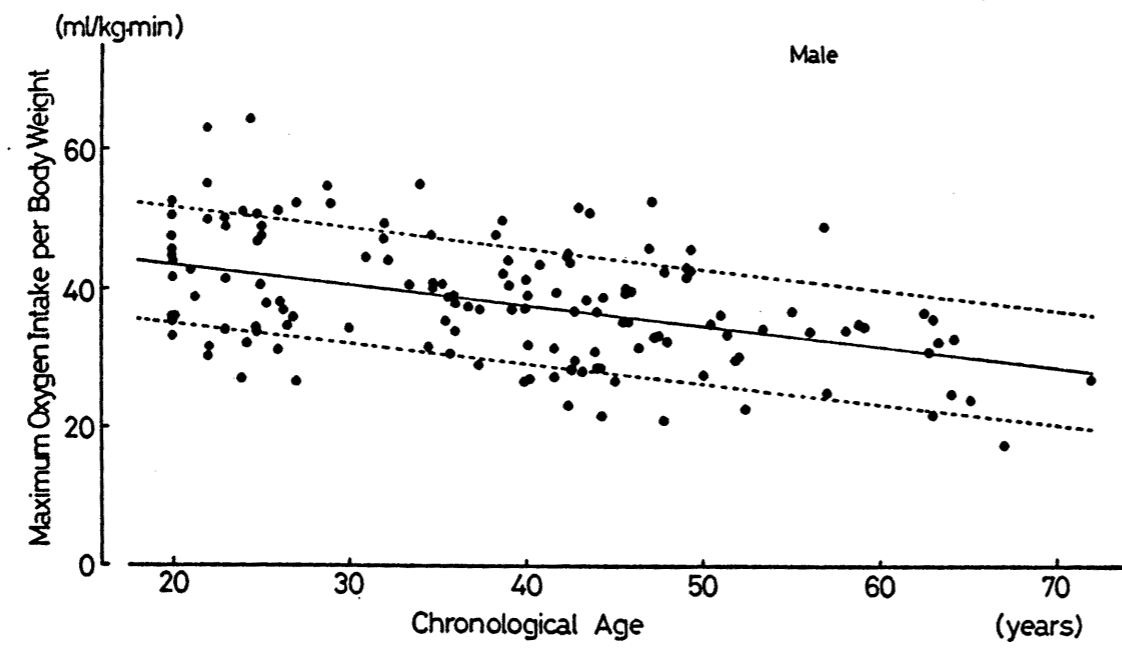


図70、一般健康成人男子の体重あたり最大酸素摂取量。

Researcher	Items	Age Group (Years)				
		30 - 39	40 - 49	50 - 59	60 - 69	70 - 79
Binkhorst. (Netherland)	Number of Subj.	17	13	9	-	-
	$\dot{V}O_2$ max. (l/min)	2.86	2.59	2.37	-	-
	$\dot{V}O_2$ max./W. (ml/kg.min)	39.0	35.3	31.3	-	-
Robinson. (American)	Number of Subj.	10	10	9	8	3
	$\dot{V}O_2$ max. (l/min)	3.42	2.92	2.63	2.35	1.71
	$\dot{V}O_2$ max./W. (ml/kg.min)	43.1	39.5	38.4	34.5	25.5
Åstrand. (Swedish)	Number of Subj.	13	9	66	8	-
	$\dot{V}O_2$ max. (l/min)	3.01	2.99	2.54	2.23	-
	$\dot{V}O_2$ max./W. (ml/kg.min)	39.8	39.2	33.1	31.4	-
Tlustý (Czech)	Number of Subj.	-	-	25	25	13
	$\dot{V}O_2$ max. (l.min)	-	-	2.24	1.87	1.56
	$\dot{V}O_2$ max./W. (ml/kg.min)	-	-	28.8	25.4	22.2
Hermansen (Norwegian)	Number of Subj.	24	16	17	-	-
	$\dot{V}O_2$ max. (l/min)	3.16	2.93	2.58	-	-
	$\dot{V}O_2$ max./W/ (ml/kg.min)	41.8	39.3	36.1	-	-
This Study. (Japanese)	Number of Subj.	27	45	15	9	1
	$\dot{V}O_2$ max. (l/min)	2.45	2.19	2.07	1.74	1.39
	$\dot{V}O_2$ max./W. (ml/kg.min)	40.6	36.3	34.0	28.8	27.1

表19. 一般健康成人男子の最大酸素摂取量の国際比較.

Age (years)		20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 - 72
Items							
5-16 KM Running per Day	Number of Subjects		2	3	6	3	
	Body Height (cm)		163.6 ± 4.15	166.3 ± 5.19	157.0 ± 5.24	156.2 ± 3.52	
	Body Weight (kg)		62.2 ± 2.85	58.3 ± 2.87	49.4 ± 6.57	49.4 ± 3.85	
	Max. Ventilation (l/min)		104.4 ± 5.05	92.0 ± 21.7	60.4 ± 8.3	60.4 ± 8.4	
	Max. Oxygen Intake (l/min)		3.67 ± 0.01	3.03 ± 0.53	2.41 ± 0.32	2.33 ± 0.09	
	Max. Oxygen Intake per Body Weight (ml/kg.min)		59.9 ± 2.25	51.6 ± 7.03	49.2 ± 6.49	47.4 ± 1.76	
	Max. Heart Rate (beats/min)		187.0 ± 6.0	182.0 ± 1.6	166.5 ± 3.9	167.0 ± 2.2	
Max. Respiratory Rate (freq./min)		60.0 ± 4.0	51.0 ± 4.1	42.2 ± 6.3	41.3 ± 4.2		
3-4 KM Running per Day	Number of Subjects		5	6	3	2	1
	Body Height (cm)		163.8 ± 6.48	167.9 ± 4.98	162.5 ± 6.38	159.3 ± 1.00	165.9
	Body Weight (kg)		63.7 ± 11.25	63.8 ± 3.71	57.0 ± 7.48	59.0 ± 1.00	49.0
	Max. Ventilation (l/min)		80.8 ± 9.7	84.2 ± 10.7	61.5 ± 14.1	59.3 ± 9.0	65.7
	Max. Oxygen Intake (l/min)		2.84 ± 0.42	3.17 ± 0.27	2.24 ± 0.05	2.15 ± 0.39	1.62
	Max. Oxygen Intake per Body Weight (ml/kg.min)		45.1 ± 4.67	49.5 ± 4.09	40.0 ± 4.71	36.4 ± 6.05	34.5
	Max. Heart Rate (beats/min)		175.2 ± 5.1	181.4 ± 6.5	156.0 ± 11.4	162.5 ± 5.5	148
Max. Respiratory Rate (freq./min)		46.8 ± 5.2	44.1 ± 7.0	38.3 ± 3.3	38.0 ± 2.0	41	
1-2 Times Running per Week	Number of Subjects	45	12	25	7	6	1
	Body Height (cm)	167.7 ± 5.74	165.5 ± 4.92	164.6 ± 5.22	163.1 ± 2.42	163.4 ± 5.17	148.2
	Body Weight (kg)	59.9 ± 8.75	63.1 ± 6.33	58.7 ± 8.93	60.9 ± 3.72	63.0 ± 3.87	51.5
	Max. Ventilation (l/min)	83.8 ± 21.6	92.5 ± 22.1	69.6 ± 12.1	65.3 ± 12.1	65.5 ± 8.6	45.7
	Max. Oxygen Intake (l/min)	2.57 ± 0.62	2.78 ± 0.36	2.33 ± 0.50	2.18 ± 0.35	2.03 ± 0.25	1.36
	Max. Oxygen Intake per Body Weight (ml/kg.min)	42.7 ± 9.09	44.6 ± 5.41	40.0 ± 6.88	35.8 ± 6.05	32.4 ± 3.77	27.1
	Max. Heart Rate (beats/min)	188.3 ± 11.8	181.1 ± 7.7	177.0 ± 8.5	175.7 ± 9.0	162.2 ± 9.5	161
Max. Respiratory Rate (freq./min)	49.6 ± 11.9	48.5 ± 12.8	41.3 ± 6.8	42.1 ± 9.4	40.5 ± 7.8	31	
Sedentary	Number of Subjects		15	20	8	3	
	Body Height (cm)		165.2 ± 4.13	165.2 ± 5.61	164.0 ± 3.15	158.7 ± 5.70	
	Body Weight (kg)		59.0 ± 6.20	64.5 ± 11.44	60.8 ± 8.12	54.3 ± 5.26	
	Max. Ventilation (l/min)		68.7 ± 10.5	60.4 ± 14.8	63.5 ± 8.4	30.2 ± 2.2	
	Max. Oxygen Intake (l/min)		2.19 ± 0.30	2.02 ± 0.41	1.98 ± 0.38	1.15 ± 0.04	
	Max. Oxygen Intake per Body Weight (ml/kg.min)		37.4 ± 5.34	31.8 ± 6.56	32.4 ± 3.23	21.5 ± 2.70	
	Max. Heart Rate (beats/min)		179.6 ± 10.0	174.8 ± 12.9	174.0 ± 5.8	157.7 ± 11.9	
Max. Respiratory Rate (freq./min)		43.6 ± 5.4	37.1 ± 6.0	40.8 ± 8.4	29.7 ± 1.7		

(Mean ± S.D.)

表20. 中高年スポーツ愛好者の最大酸素摂取量測定結果.

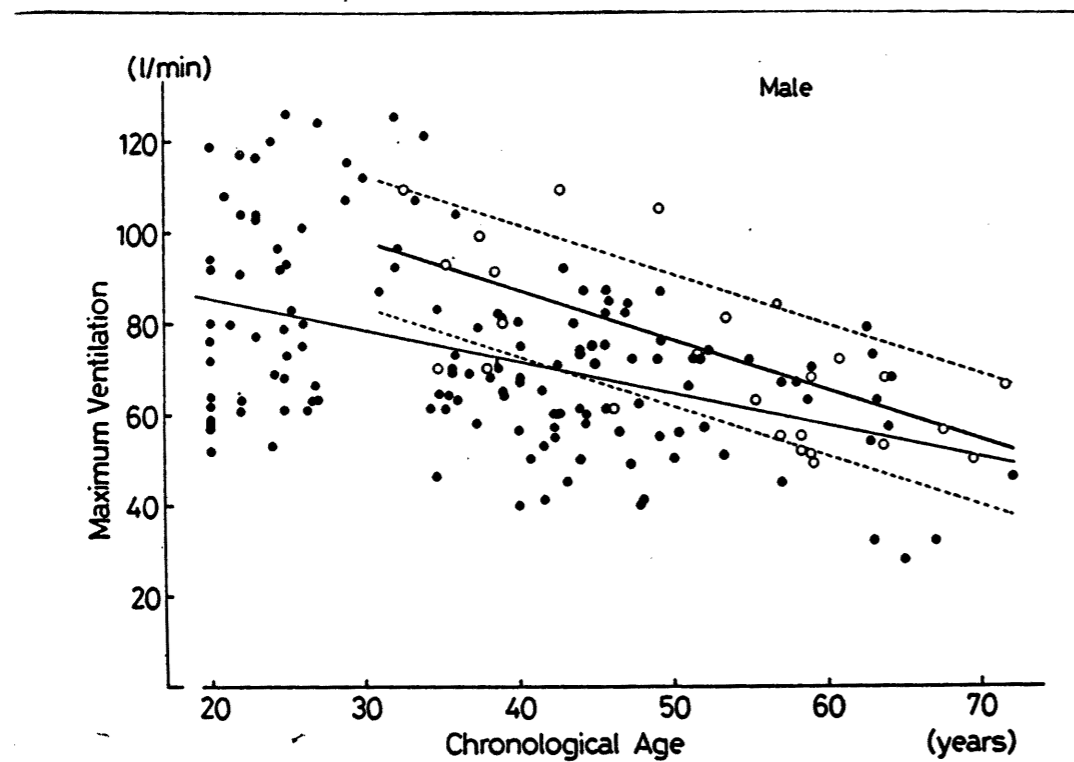


図71. スポーツ愛好者及び一般健康成人の最大換気量。(男子)

○: スポーツ愛好者. ●: 一般健康成人.
 太い黒線及び破線は、スポーツ愛好者の回帰直線とその標準偏差.
 細い黒線は、一般健康成人の回帰直線

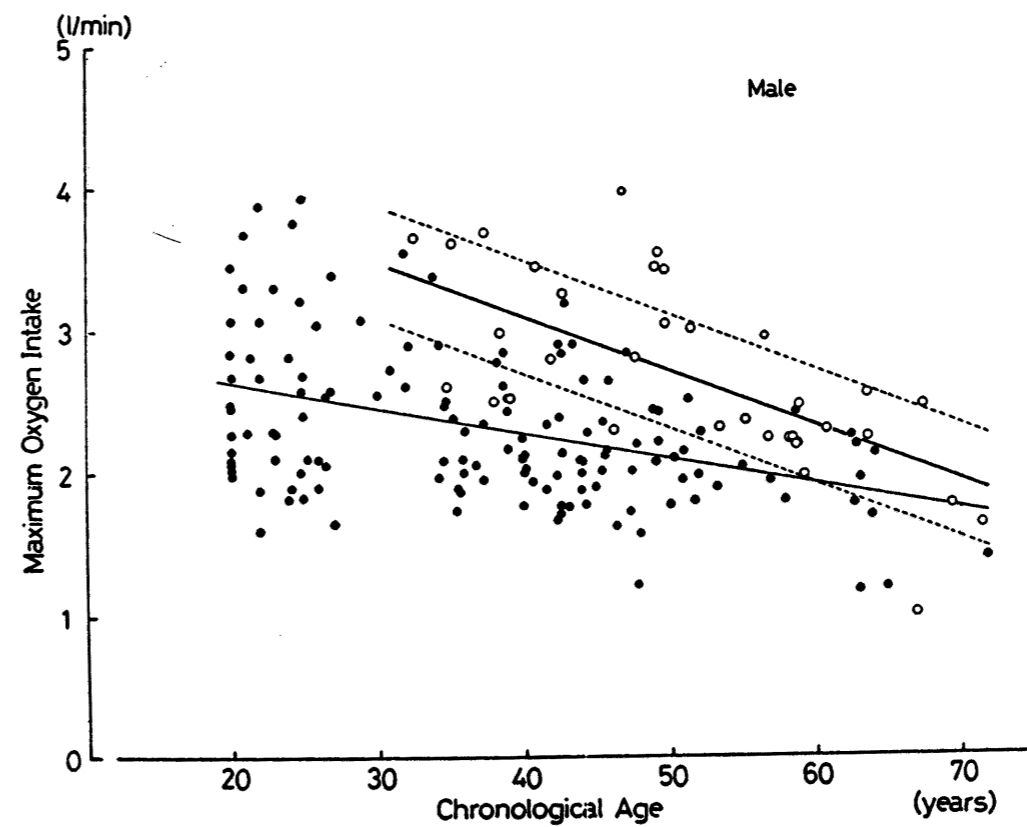


図72. スポーツ愛好者及び一般健康成人の最大酸素摂取量。(男子)

○: スポーツ愛好者. ●: 一般健康成人.
 太い黒線及び破線は、スポーツ愛好者の回帰直線とその標準偏差.
 細い黒線は、一般健康成人の回帰直線

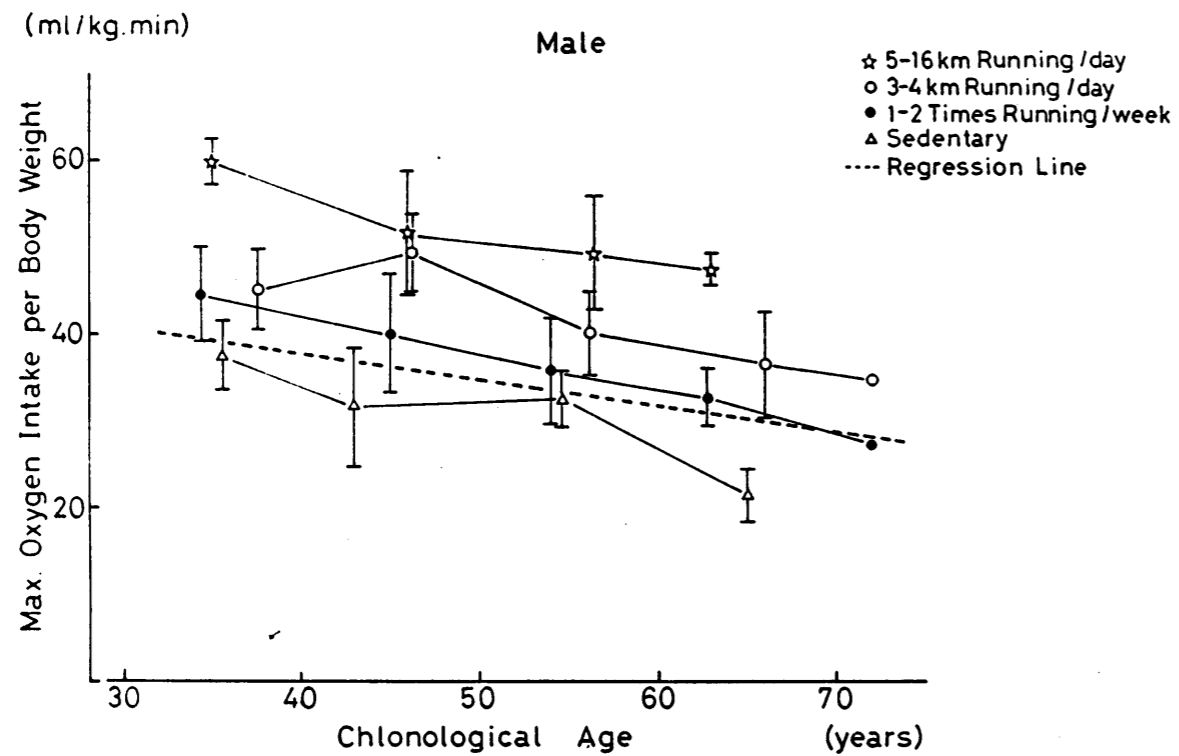


図73. 運動実施群別に見た体重あたり最大酸素摂取量。(男子)
(破線は、一般健康男子の回帰直線)

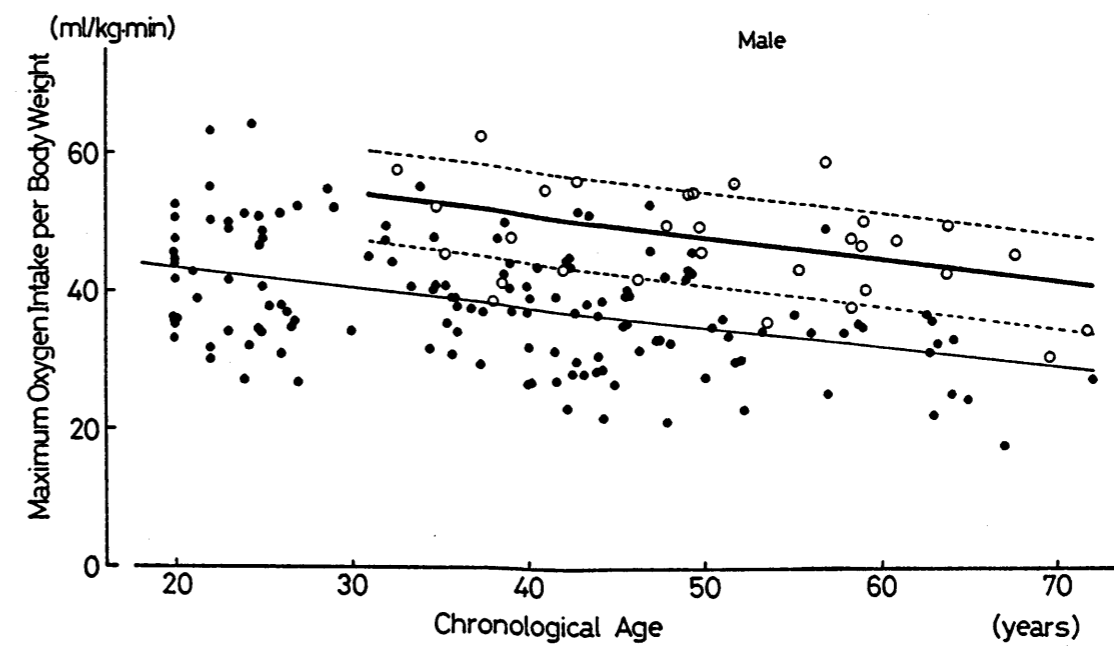


図74. スポーツ愛好者及び一般健康成人の体重あたり最大酸素摂取量(男子)
(○: スポーツ愛好者, ●: 一般健康成人)
(太い黒線及び破線は、スポーツ愛好者の回帰直線とその標準偏差。
細い黒線は、一般健康成人の回帰直線)

Items \ Age	Non-Athletic Female						Athletes
	19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	19 - 30
Number	18	26	30	29	6	3	17
Body Height (cm)	157.1 ± 4.4	155.6 ± 2.7	155.2 ± 2.8	152.7 ± 4.6	152.4 ± 6.4	150.6 ± 5.3	159.2 ± 4.7
Body Weight (kg)	52.3 ± 5.86	52.4 ± 4.54	52.5 ± 5.85	53.1 ± 6.97	54.5 ± 5.61	41.7 ± 7.59	56.5 ± 5.34
Max. Ventilation (STPD) (l/min)	66.7 ± 13.6	60.1 ± 13.5	46.5 ± 10.1	41.4 ± 9.5	37.6 ± 8.0	21.4 ± 7.6	86.8 ± 11.2
Max. Oxygen Intake (l/min)	1.89 ± 0.31	1.75 ± 0.36	1.59 ± 0.24	1.43 ± 0.25	1.34 ± 0.34	0.76 ± 0.47	2.63 ± 0.50
Max. Oxygen Intake per Body Weight (ml/kg.min)	36.2 ± 4.81	33.7 ± 6.84	30.3 ± 3.88	27.1 ± 4.93	24.6 ± 5.47	16.8 ± 7.55	46.4 ± 7.48
Max. Heart Rate (beats/min)	189.9 ± 11.3	188.9 ± 10.7	175.0 ± 8.73	174.3 ± 10.6	162.0 ± 7.2	148.5 ± 4.5	192.8 ± 6.3
Max. Respiratory Rate (freq./min)	50.0 ± 6.3	49.5 ± 7.8	38.6 ± 7.2	37.8 ± 6.5	35.3 ± 4.1	32.1 ± 5.0	54.7 ± 7.5
Oxygen Pulse (ml/beat)	10.00 ± 1.96	9.26 ± 1.96	9.12 ± 1.26	8.22 ± 1.41	8.27 ± 2.13	6.42 ± 2.88	13.70 ± 2.59

(Mean ± S.D.)

Results for Non-Athletic and Athletic Female

表21. 一般健康成人女子及び運動選手の最大酸素摂取量測定結果.

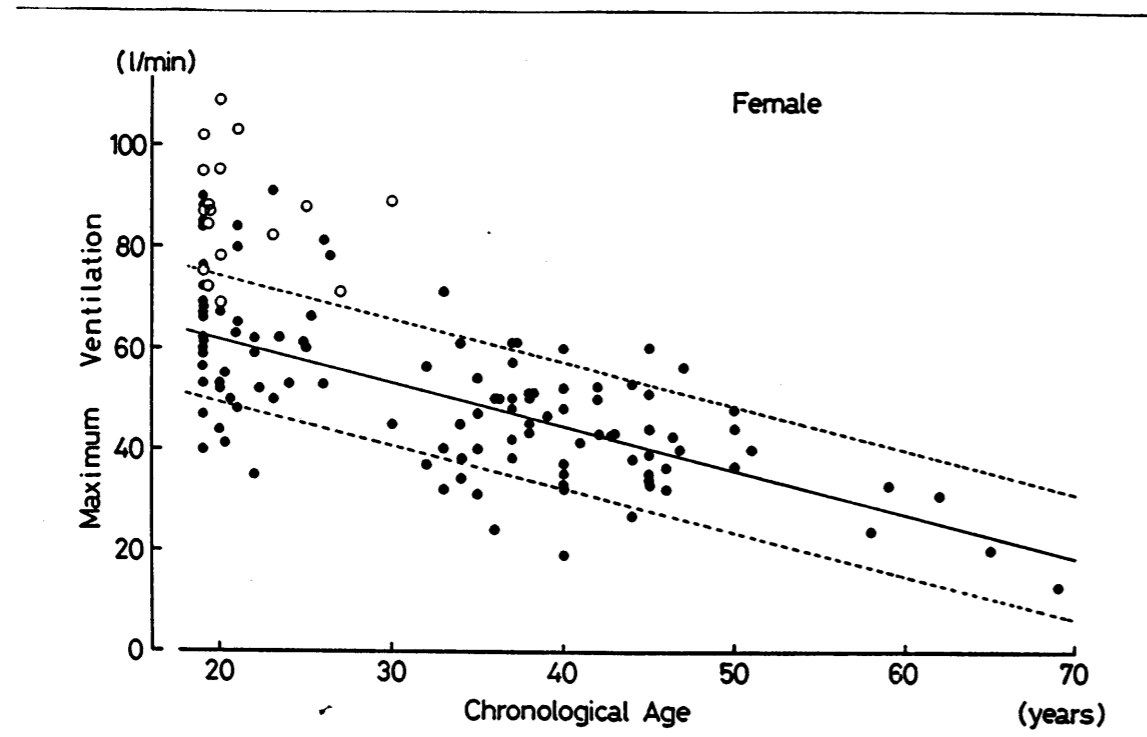


図75. 健康成人女子の最大換気量
 (○: 運動選手
 ●: 一般健康成人女子)

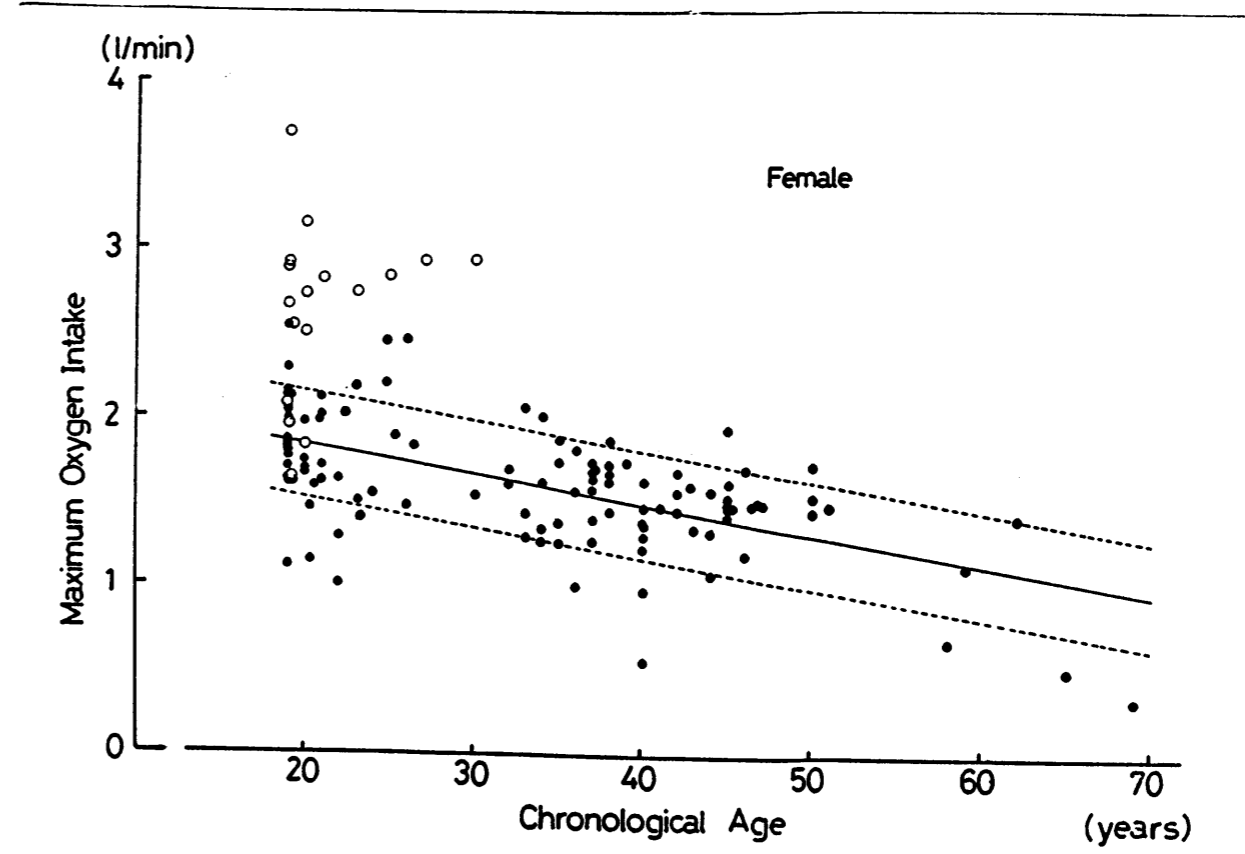


図76. 健康成人女子の最大酸素摂取量
 (○: 運動選手
 ●: 一般健康成人女子)

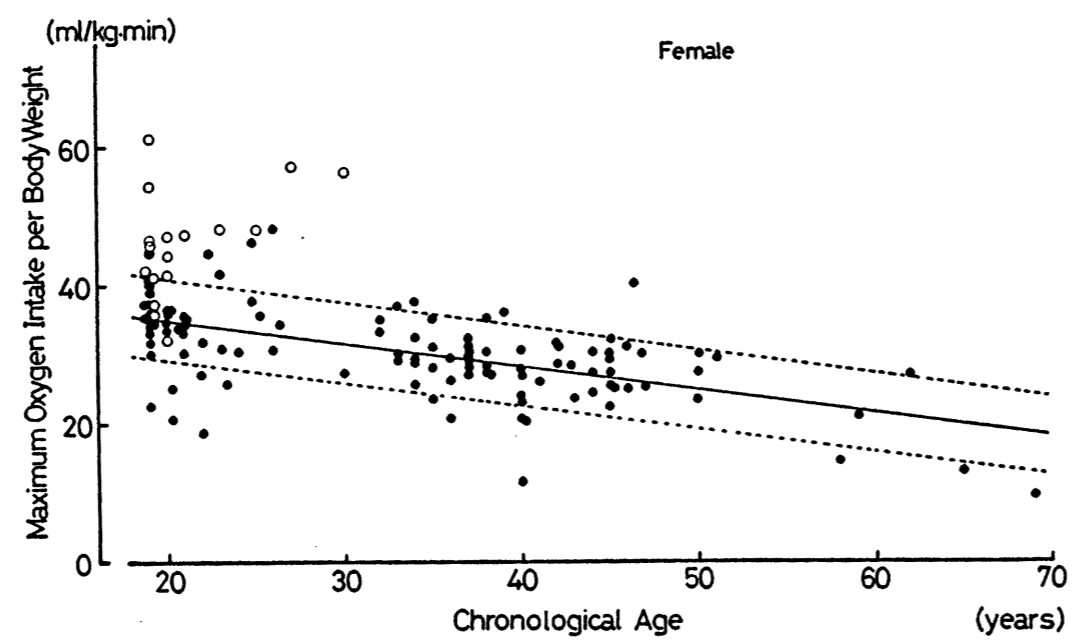


図77. 健康成人女子の体重あたり最大酸素摂取量.
 (○: 運動選手
 ●: 一般健康成人女子)

Researcher	Age Group (Years)				
	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69
Profant (American)	-	28.3	25.7	24.5	18.7
Brown (Canadian)	-	-	28.2	29.6	22.9
Trusty (Czech)	-	-	-	25.4	22.1
Kilbom (Swedish)	36.8	31.0		26.9	
Hermansen (Norwegian)	37.9	33.2	32.9	28.5	-
Atomi (Japanese)	32.4	27.9	26.0	24.4	-
This Study	33.7	30.3	27.1	24.6	16.8

* Maximum Oxygen Intake per Body Weight.
(ml/kg.min)

表22. 一般健康成人女子の体重あたり最大酸素摂取量の国際比較.

Subject (Male)	Age (years)	Body Height (cm)	Body Weight (kg)	\dot{V}_e max. (STPD) (l/min)	\dot{V}_{O_2} max. (l/min)	\dot{V}_{O_2} max. /W (ml/kg.min)	Max.H.R. (beats/min)	Max.R.R. (freq./min)	Note
Izumi	20.1 21.2 22.2	166.7 166.7 166.5	62.5 62.0 61.5	83.6 96.9 94.4	3.29 3.25 2.68	52.6 52.4 43.6	196 190 188	55.5 55.0 55.0	* * *
Taguchi	21.3 24.8	171.5 173.1	61.5 63.5	86.0 91.5	2.83 3.22	46.0 50.7	198 199	55.3 50.0	* *
Yamazaki	24.0 25.0	173.0 173.0	58.0 55.0	73.6 93.1	2.33 2.69	40.2 48.9	198 198	68.0 72.0	o *
Amano	24.3 32.6	167.5 167.8	67.0 65.0	143.5 109.4	4.03 3.65	60.1 57.6	192 193	84.0 64.0	*** ***
Sasaki	31.0 34.7	157.0 156.8	45.0 43.7	42.8 45.5	1.81 2.09	40.2 47.9	186 192	33.0 35.0	* *
Hishida	32.3 33.3 34.3	170.5 170.5 170.6	65.5 65.5 65.0	95.5 84.6 104.2	2.90 2.69 3.04	44.3 41.1 46.7	184 180 187	44.0 43.0 48.0	* * *
Ozawa	35.3 36.4 37.4	159.0 159.0 159.0	58.5 58.5 58.0	61.4 47.1 69.9	2.39 2.45 2.79	40.9 41.9 48.1	181 176 178	37.0 32.0 41.0	* * *
Hayashi	38.3 39.3 40.4	168.3 168.0 168.9	58.0 57.0 57.0	68.1 57.9 78.8	2.78 2.71 3.15	47.9 47.5 59.3	180 181 183	34.0 29.0 42.0	* * *
Nonogaki	38.7 39.8	160.0 160.0	57.5 56.5	69.8 86.7	2.62 3.09	50.0 54.8	181 188	39.0 40.0	* *
Seikawa	39.0 40.0	162.0 162.0	57.0 57.0	80.9 100.1	2.53 2.88	44.4 50.5	170 182	53.0 60.0	** **
Togashi	40.7 41.9	161.8 162.1	44.5 43.0	50.1 46.7	1.94 2.04	43.7 47.5	182 178	36.0 31.0	* *
Nakajima	42.3 45.3	162.5 162.8	65.0 64.5	90.0 88.5	2.80 2.69	43.1 41.8	193 177	38.5 47.0	** **
Yoshida	42.5 43.5	175.5 176.0	56.4 57.0	65.5 80.1	2.41 2.91	42.7 51.1	186 179	38.0 44.0	* *
Momoyama	42.8 43.8	170.0 170.0	58.0 61.0	109.3 101.9	3.25 3.56	56.2 58.4	180 180	51.0 50.0	*** ***
Narasaki	44.0 45.2	163.5 163.4	51.5 51.5	49.7 52.8	1.88 2.12	36.5 41.2	179 181	34.0 35.0	* *
Atarashi	47.3 48.3 49.3 50.5	158.2 158.3 158.3 158.1	53.5 53.0 53.0 52.5	92.1 101.2 86.9 99.3	2.37 2.27 2.43 2.45	44.2 42.8 45.9 46.7	178 180 171 171	52.0 55.0 50.0 54.0	* * * *
Nakagome	47.4 48.5	175.0 175.0	60.5 60.0	72.4 69.9	2.01 2.03	33.2 33.9	184 181	45.0 46.0	* *
Mizutani	49.1 50.1 51.2	162.6 162.6 162.5	66.0 64.0 64.5	55.6 50.4 55.9	1.71 1.77 1.94	25.9 27.7 30.1	173 180 177	50.0 56.0 51.0	* * *
Kondou	49.1 50.2	159.7 159.7	48.4 48.5	54.7 80.3	2.08 2.25	43.0 46.3	165 181	33.5 42.0	* *
Douura	50.4 51.6	166.3 166.2	60.0 62.5	56.0 52.2	2.10 1.74	34.9 27.9	173 163	32.0 31.0	* *

表 23-a. 最大酸素摂取量の個人別追跡測定結果 (男子)

Subject	Age (years)	Body Height (cm)	Body Weight (kg)	\dot{V}_e max. (STPD) (l/min)	\dot{V}_{O_2} max. (l/min)	\dot{V}_{O_2} max./W (ml/kg.min)	Max.H.R. (beats/min)	Max.R.R. (freq./min)	Note
Male	50.5	158.8	56.0	71.4	2.50	43.1	171	45.0	***
	51.6	158.8	54.0	72.9	3.00	55.6	172	52.0	***
Kato	61.6	163.4	62.5	77.0	2.23	35.7	174	52.0	*
	62.6	163.0	62.6	78.6	2.25	36.8	180	54.0	*
	63.8	163.1	62.5	88.9	2.57	41.2	178	57.0	*
Shimo	62.7	151.4	44.5	42.2	1.98	44.4	156	35.0	***
	63.7	151.4	45.2	52.7	2.24	49.5	165	37.0	***
Kumagai	62.7	159.3	63.5	68.0	2.38	37.5	173	36.0	**
	63.7	159.3	60.0	68.4	2.54	42.4	168	36.0	**
Suga	70.1	165.9	49.0	59.9	1.64	33.5	136	34.0	**
	71.6	165.9	49.0	65.7	1.62	34.5	148	41.0	**
Female	20.8	153.0	59.5	94.8	2.50	42.0	204	60.0	***
	21.8	153.0	62.0	84.3	2.12	34.2	178	48.0	*
Iwamoto	24.8	153.0	58.5	59.9	2.20	37.6	178	37.0	*
	21.4	158.0	56.0	65.0	1.71	30.5	210	51.0	*
Toda	23.4	157.5	54.5	61.6	1.40	25.7	174	52.0	*
	21.3	158.0	57.0	80.3	2.01	35.3	198	60.0	*
Moriya	25.3	157.2	52.5	66.0	1.89	35.9	189	54.0	*
	22.7	156.4	50.5	62.0	1.63	32.3	174	51.0	o
Itahashi	26.4	156.5	53.0	77.5	1.83	34.5	183	60.0	o
	23.0	150.9	52.0	91.1	2.18	41.9	192	57.0	o
Ogura	24.8	150.3	53.0	61.0	2.45	46.3	174	47.0	o
	42.8	155.0	56.0	43.4	1.60	28.6	182	35.0	*
Narasaki	45.0	154.4	55.0	32.9	1.62	29.4	176	29.0	*
	44.7	144.6	48.0	38.0	1.33	27.7	176	38.0	*
Mizutani	45.8	144.6	49.0	39.4	1.48	30.1	179	40.0	*
	46.8	145.0	50.0	39.5	1.51	30.2	181	40.0	*

o: Sedentary. *: 1-2 Times Running per Week.
 : 3-4 KM Running per Day. *: 5-16 KM Running per Day.

表 23-b. 最大酸素摂取量の個人別追跡測定結果。(男子, 女子)

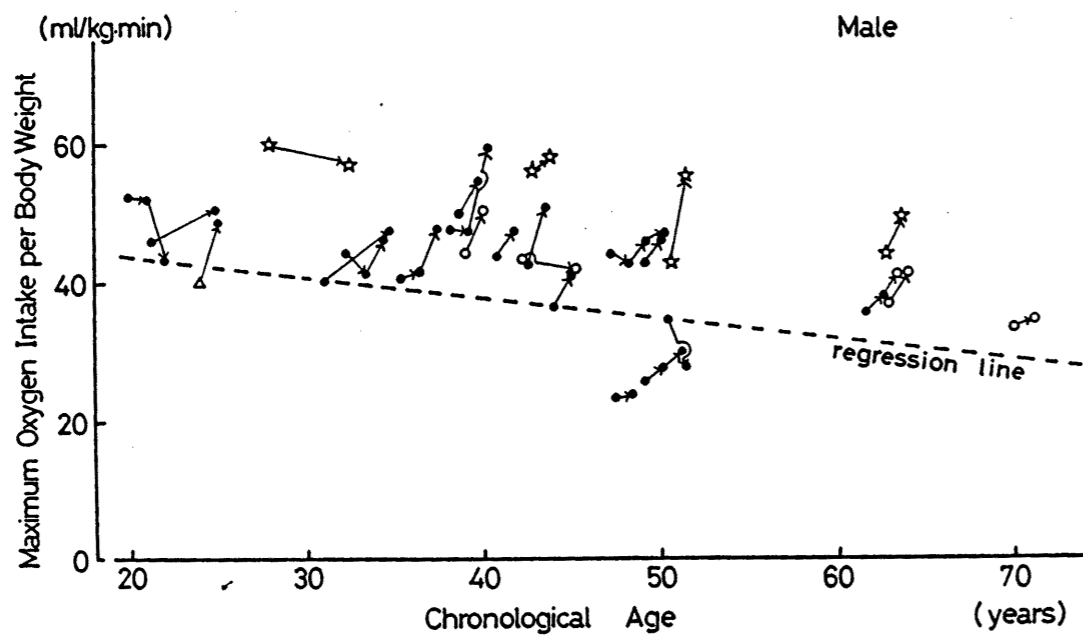


図 78. 最大酸素摂取量の個人別推移.
(男子)

- ☆ : 毎日 5~16 KM 走り人.
 - : 毎日 3~4 KM 走り人.
 - : 週 1~2 回 運動する人.
 - △ : 運動しない人.
- 破線は、一般健康成人男子の回帰直線

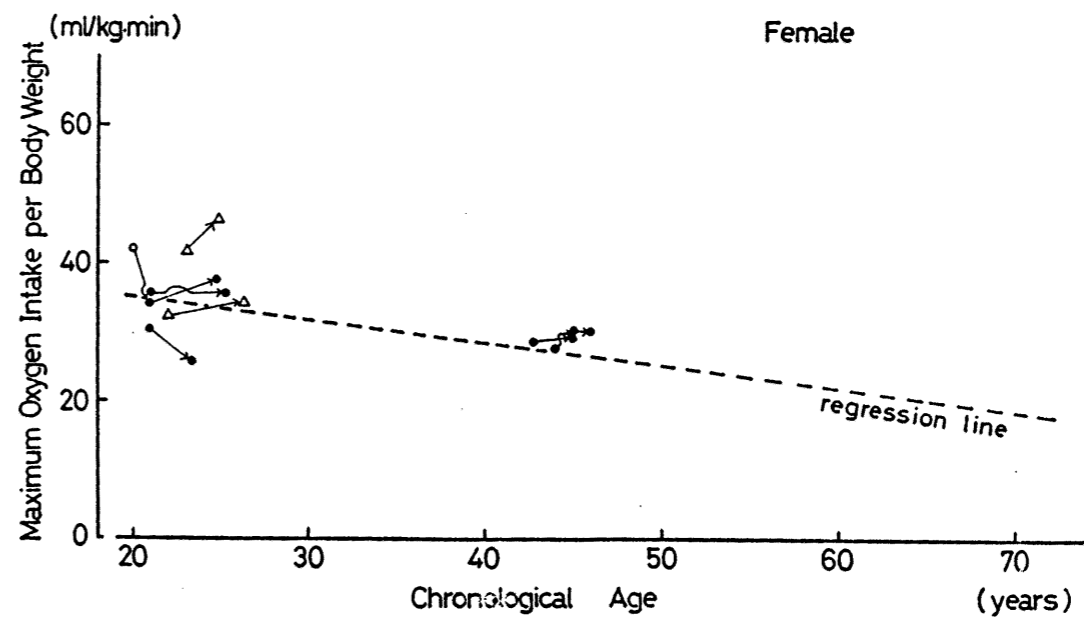


図 79. 最大酸素摂取量の個人別推移.
(女子)

- : 運動選手.
 - : 週 1~2 回 運動する人.
 - △ : 運動しない人.
- 破線は、一般健康成人女子の回帰直線

subject	Age (years)	Body Height (cm)	Body Weight (kg)	Exhaustive Time (min)	\dot{V}_e max. (STPD) (l/min)	$\dot{V}o_2$ max. (l/min)	$\dot{V}o_2$ max/W (ml/kg.min)	Max.H.R. (beats/min)	Max.R.R. (freq./min)	Ventilatory Equivalent ($\dot{V}_e/\dot{V}o_2$)	Tidal Volume (l/freq.)	Oxygen Pulse (ml/beat)
I.G.	21	168.0	58.0	21:23	98.7:108.8	3.56:3.71	61.4:64.0	189:198	45:52	27.7:29.3	2.19:2.09	18.8:18.7
I.S.	22	171.5	58.0	21:23	123.0:112.0	3.77:3.56	65.0:61.4	201:199	58:63	32.6:31.5	2.12:1.78	18.8:17.9
F.U.	22	163.0	62.0	15:19	94.4: 93.8	3.03:2.91	48.9:46.9	182:188	49:58	31.2:33.0	1.93:1.65	16.7:15.6
Mean	21.7	167.5	59.3	19:21.7	105.4:105.6	3.45:3.39	58.4:57.4	191:193	51:58	30.5:31.3	2.08:1.84	18.1:17.4
M.H.	36	162.0	53.0	11:14	62.9: 77.0	2.00:2.24	37.7:42.3	166:172	50:63	31.5:34.4	1.26:1.22	12.1:13.0
M.Y.	37	164.0	67.5	14:14.5	121.4:129.0	2.56:2.76	37.9:41.2	172:178	64:64	47.4:46.7	1.90:2.02	14.7:15.5
W.A.	39	167.5	60.0	12:16	65.0: 82.6	2.43:2.71	40.5:45.2	184:191	44:41	26.8:30.5	1.48:2.01	13.2:14.2
H.O.	39	162.0	57.0	12:18	88.1: 99.8	2.45:2.53	43.0:44.0	170:186	53:53	36.0:39.4	1.66:1.88	14.4:13.6
Y.S.	41	153.0	56.5	14:19	61.2: 63.3	2.06:2.27	36.5:39.1	171:180	33:30	29.7:27.9	1.85:2.10	12.1:12.6
H.A.	41	163.0	65.0	11:12	43.2: 43.3	1.76:1.82	26.7:28.0	167:170	24:26	24.5:23.8	1.80:1.67	10.6:10.1
Y.A.	48	165.0	48.0	12:16	45.6: 50.6	1.56:1.83	32.5:37.5	169:181	29:29	29.2:27.7	1.57:1.74	9.2:10.1
N.A.	55	160.0	55.5	16:20	72.3:104.1	2.04:2.25	36.8:39.5	179:183	43:47	35.4:46.3	1.68:2.21	11.3:12.3
I.D.	57	164.0	57.0	16:15	67.3: 61.3	1.94:1.95	34.0:34.2	165:154	41:34	34.7:31.4	1.64:1.80	11.8:12.7
M.U.	58	165.0	53.0	18:19	67.1: 70.1	1.80:1.98	34.0:37.4	183:181	36:35	37.3:35.4	1.86:2.00	9.8:10.9
Mean	45.1	162.6	57.3	13.6:16.4	69.4: 78.1	2.06:2.23	36.0:38.8	173:181	42:42	33.2:34.4	1.67:1.87	11.9:12.5

* Before Training : After Training (10 Weeks)

* \dot{V}_e max.;Maximum Ventilation. $\dot{V}o_2$ max.;Maximum Oxygen Intake

$\dot{V}o_2$ max./W.;Maximum Oxygen Intake per Body Weight. Max.H.R.;Maximum Heart Rate.

Max.R.R.;Maximum Respiratory Rate.

表24. 10週間歩行トレーニングにおける、トレーニング前後の最大酸素摂取量測定結果.

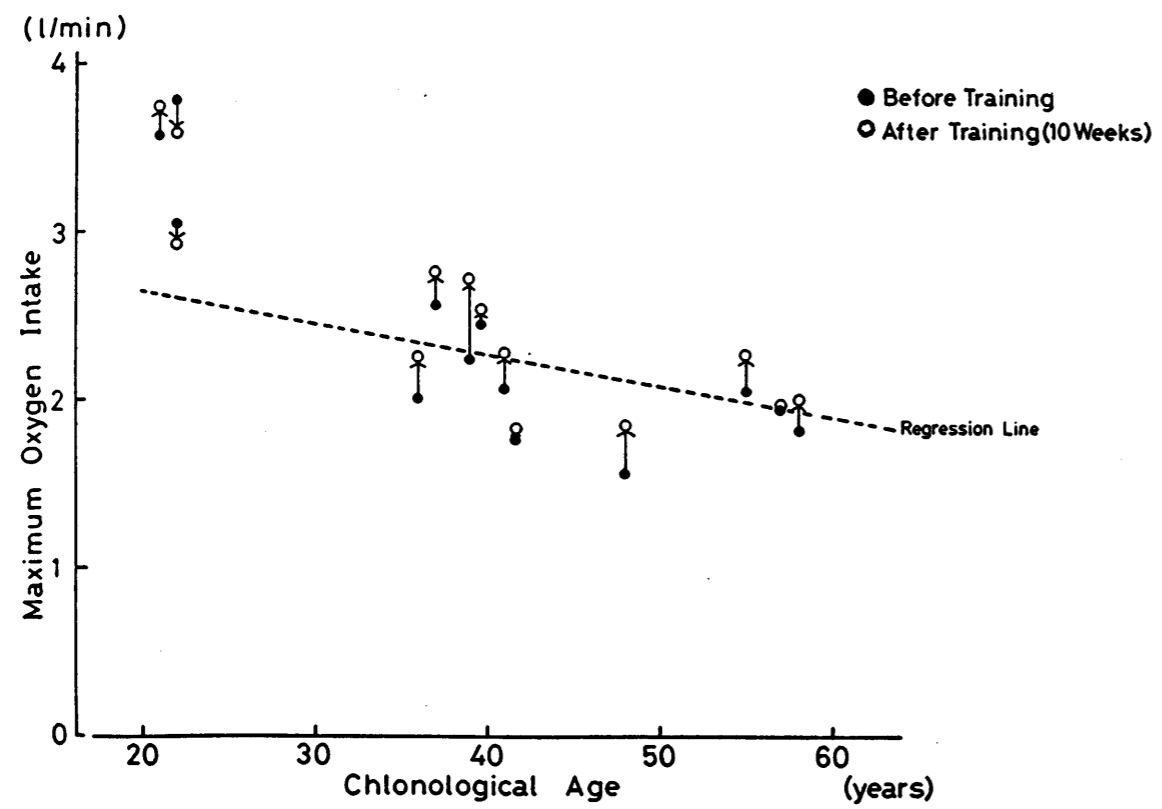


図80. 10週間歩行トレーニングによる最大酸素摂取量の変動

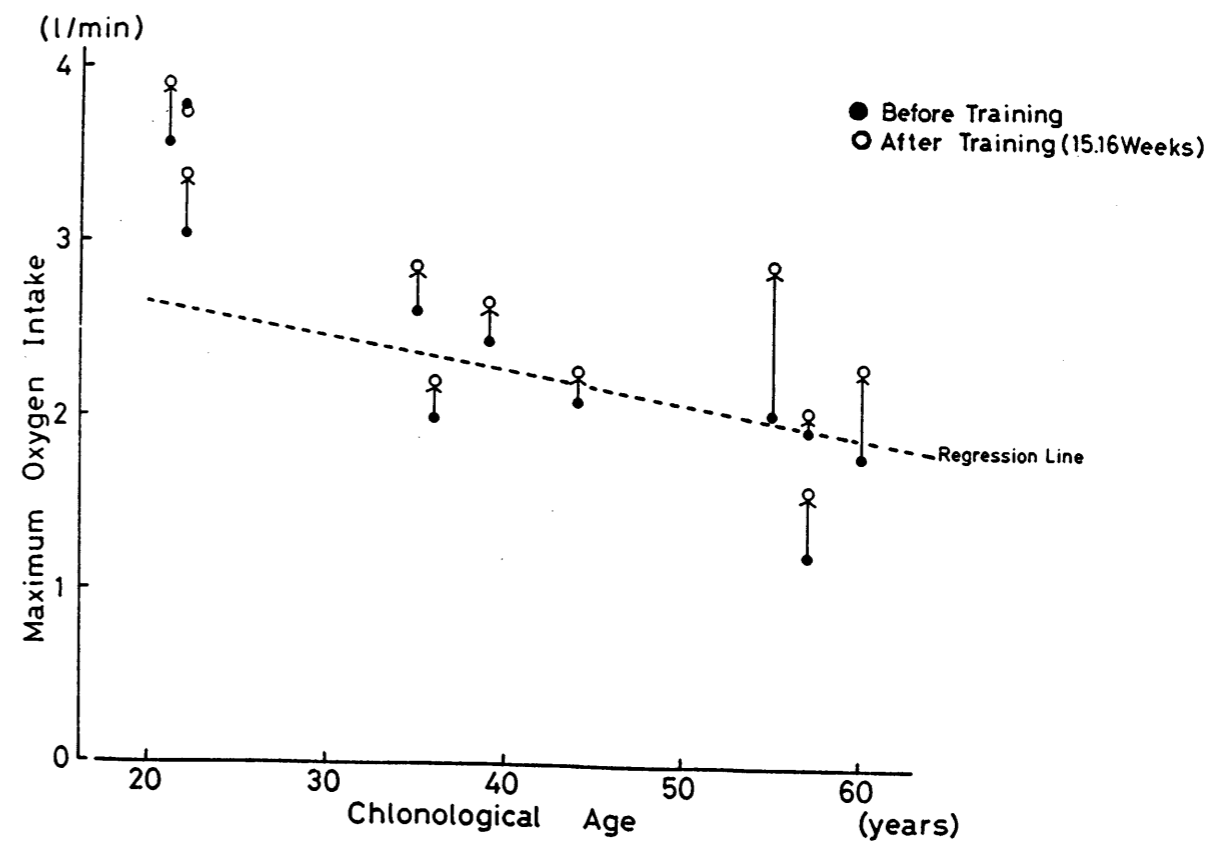


図81. 15.16週間歩行トレーニングによる最大酸素摂取量の変動.

Subject	Age (years)	Body Height (cm)	Body Weight (kg)	Exhaustive Time (min)	\dot{V}_e max. (STPD) (l/min)	$\dot{V}O_2$ max. (l/min)	$\dot{V}O_2$ max./W (ml/kg.min)	Max.H.R. (beats/min)	Max.R.R. (freq./min)	Ventilatory Equivalent ($\dot{V}_e/\dot{V}O_2$)	Tidal Volume (l/freq.)	Oxygen Pulse (ml/beat)
I.G.	21	168.0	58.0	21:24	98.7:120.0	3.56:3.90	61.4:67.2	189:196	45:57	27.7:30.8	2.19:2.11	18.8:19.9
I.S.	22	171.5	58.0	21:24	123.0:122.0	3.77:3.73	65.0:64.3	201:196	58:70	32.6:32.7	2.12:1.74	18.8:19.0
F.U.	22	163.0	62.0	15:23	94.4: 93.8	3.03:3.37	48.9:54.4	182:203	49:57	31.2:27.8	1.93:1.65	16.7:16.6
Mean	21.7	167.5	59.3	19:21.7	105.4:105.6	3.45:3.39	58.4:57.4	191:199	51:58	30.5:31.3	2.08:1.84	18.1:17.4
M.I.	35	165.0	66.0	15.5:17	106.3:104.6	2.61:2.86	39.5:43.3	178:174	59:65	40.7:36.6	1.80:1.60	14.7:16.4
M.A.	36	162.0	53.0	11:18	62.9: 83.6	2.00:2.20	37.7:41.5	166:171	50:66	31.5:38.0	1.26:1.27	12.1:12.9
W.A.	39	167.5	60.0	12:20	65.0: 79.4	2.43:2.64	40.5:44.0	184:207	44:43	26.8:30.1	1.48:1.85	13.2:12.2
M.T.	44	168.0	70.5	14:14.5	60.5: 64.2	2.09:2.27	30.7:32.2	154:163	33:35	29.0:28.3	1.83:1.83	13.6:13.9
N.A.	55	160.0	55.5	16:22	72.3:104.2	2.04:2.89	36.8:49.8	179:191	43:50	35.4:36.1	1.68:2.08	11.3:15.1
I.D.	57	164.0	57.0	16:15	67.3: 57.8	1.94:2.05	34.0:36.3	165:150	41:34	34.7:27.9	1.64:1.70	11.8:13.8
K.I.	57	171.0	47.0	12:15	44.5: 66.8	1.22:1.61	25.7:34.3	166:186	32:48	36.5:41.5	1.39:1.39	7.4: 8.7
M.U.	58	165.0	53.0	18:21	67.1: 68.9	1.80:2.31	34.0:42.8	183:180	36:34	37.3:29.8	1.86:2.03	9.8:12.8
Mean	50.4	165.3	57.8	14.3:17.8	68.2: 78.7	2.02:2.35	34.9:40.5	172:178	42:47	34.0:33.5	1.62:1.72	11.7:13.2

* Before Training : After Training (15.16 Weeks)

* \dot{V}_e max.;Maximum Ventilation. $\dot{V}O_2$ max.;Maximum Oxygen Intake.

$\dot{V}O_2$ max./W; Maximum Oxygen Intake per Body Weight. Max.H.R.;Maximum Heart Rate.

Max.R.R.;Maximum Respiratory Rate.

表 25. 15.16週間歩行トレーニングにおける、トレーニング前後の最大酸素摂取量測定結果。

Training Weeks	10 Weeks Training			15.16 Weeks Training		
Items						
Number	10			8		
Age (years)	45.1 ± 8.2 (36 - 58)			50.4 ± 8.6 (35 - 58)		
Body Height (cm)	162.6 ± 3.73			165.3 ± 3.27		
Body Weight (kg)	57.3 ± 5.46			57.8 ± 7.09		
	Before Training	After Training	A.T./B.T. (%)	Before Training	After Training	A.T./B.T. (%)
Exhaustive Time (min)	13.60 ± 2.29	16.35 ± 2.45	20.2	14.31 ± 2.30	17.81 ± 2.74	24.5
Max. Ventilation (l/min)	69.4 ± 21.10	78.1 ± 25.08	12.5	68.2 ± 16.30	78.7 ± 16.70	15.4
Max. Oxygen Intake (l/min)	2.06 ± 0.31	2.23 ± 0.33	8.3	2.02 ± 0.39	2.35 ± 0.40	16.3
Max. Oxygen Intake per Body Weight (ml/kg.min)	36.0 ± 4.28	38.8 ± 4.78	7.8	34.9 ± 4.58	40.5 ± 5.45	16.0
Max. Heart Rate (beats/min)	172.6 ± 6.6	180.7 ± 12.1	4.7	171.9 ± 10.0	177.8 ± 16.4	3.4
Max. Respiratory Rate (freq./min)	41.7 ± 11.33	42.4 ± 13.24	1.7	42.3 ± 8.48	46.9 ± 12.21	10.9
Ventilatory Equivalent (Ve/Vo ₂)	33.2 ± 6.18	34.4 ± 7.37	3.3	34.0 ± 4.31	33.5 ± 4.80	- 1.5
Tidal Volume (l/freq.)	1.67 ± 0.19	1.87 ± 0.27	12.0	1.62 ± 0.21	1.72 ± 0.27	6.2
Oxygen Pulse (ml/beat)	11.9 ± 1.72	12.5 ± 1.66	5.0	11.7 ± 2.16	13.2 ± 2.13	12.7

(Mean ± S.D.)

表26. 10週間歩行トレーニング効果と、15.16週間歩行トレーニング効果の比較。(35才以上の被検者の場合)

Number of Subjects	3				
Age (years)	21.7 ± 0.47 (21 - 22)				
Body Height (kg)	167.5 ± 3.49				
Body Weight (kg)	59.3 ± 1.89				
	Before Training	After Training (10 Weeks)	A.T./B.T. (%)	After Training (15.16 Weeks)	A.T./B.T. (%)
Exhaustive Time (min)	19.00 ± 2.83	21.66 ± 1.89	14.0	23.66 ± 0.47	24.5
Max. Ventilation (l/min)	105.4 ± 12.6	105.6 ± 6.96	0.2	111.9 ± 12.8	6.2
Max. Oxygen Intake (l/min)	3.45 ± 0.31	3.39 ± 0.35	- 1.7	3.67 ± 0.22	6.4
Max. Oxygen Intake per Body Weight (ml/kg.min)	58.4 ± 6.90	57.4 ± 7.52	- 1.7	62.0 ± 5.48	6.2
Max. Heart Rate (beats/min)	190.7 ± 7.85	193.3 ± 7.32	1.4	198.3 ± 3.30	4.0
Max. Respiratory Rate (freq./min)	50.7 ± 5.44	57.7 ± 4.50	13.8	61.3 ± 6.13	20.9
Ventilatory Equivalent (V_e/V_{O_2})	30.5 ± 2.07	31.3 ± 1.49	2.6	30.4 ± 2.02	0.3
Tidal Volume (l/freq.)	2.08 ± 0.11	1.84 ± 0.18	- 11.5	1.83 ± 0.20	- 13.0
Oxygen Pulse (ml/beat)	18.1 ± 0.99	17.4 ± 1.35	- 3.9	18.5 ± 1.39	2.2

(Mean ± S.D.)

表27. 10週間歩行トレーニング効果と15・16週間歩行トレーニング効果の比較(20代の被検者の場合)

Subject	Age	Body Height (cm)	Body Weight (kg)	Note
	Before T.		Before/After T.	
HN	55	160	55.5/60.0	Professor :Long distance runner in his student age.
KI	57	164	57.0/57.0	Clerk of university.:Sedentary more than 20 years.
TM	58	165	53.0/55.0	Clerk of university.:Sedentary more than 20 years.

* Before T.: Before Training.
After T. : After Training.

表 28 . 50週間歩行トレーニング,被検者の形態と運動歴.

Subject	H.N.						K.I.						T.M.					
	Exhaustive Time (min)	\dot{V}_e max. (l/min)	\dot{V}_{O_2} max. (l/min)	\dot{V}_{O_2} max / W (ml/kg. min)	H.R. max. (beats /min)	R.R. max. (freq. /min)	Exhaustive Time (min)	\dot{V}_e max (l/min)	\dot{V}_{O_2} max (l/min)	\dot{V}_{O_2} max /W (ml/kg. min)	H.R. max. (beats /min)	R.R. max. (freq. /min)	Exhaustive Time (min)	\dot{V}_e max (l/min)	\dot{V}_{O_2} max (l/min)	\dot{V}_{O_2} max /W (ml/kg. min)	H.R. max. (beats /min)	R.R. max. (freq. /min)
Before Training	16'00	72.3	2.04	36.8	179	43	16'00	67.3	1.94	34.0	165	41	18'00	67.1	1.80	34.0	183	36
5 Weeks	19'00	92.9	2.01	35.9	191	47	14'00	50.3	1.98	35.4	161	34	19'00	72.7	1.95	37.1	180	37
10 Weeks	20'00	104.1	2.25	39.5	183	47	15'00	61.3	1.95	34.2	154	34	19'00	70.4	1.98	37.4	181	35
15 Weeks	22'00	104.2	2.89	49.8	191	50	15'00	57.8	2.07	36.3	150	34	21'00	68.9	2.31	42.8	180	34
20 Weeks	21'00	103.7	3.00	51.7	188	49	17'00	61.1	2.11	37.0	164	37	19'00	70.4	2.32	43.0	174	35
25 Weeks	22'00	112.8	3.28	55.6	191	53	20'00	72.0	2.49	43.7	174	38	21'00	88.6	2.54	46.2	184	41
30 Weeks	21'40	115.0	3.16	52.7	191	53	21'00	73.7	2.51	43.3	178	41	21'00	76.4	2.67	48.5	182	35
35 Weeks	23'00	112.0	2.87	47.8	188	54	20'30	74.7	2.52	43.4	184	42	-	-	-	-	-	-
40 Weeks	23'00	111.5	2.88	48.0	188	49	21'00	78.7	2.50	43.1	179	41	21'30	82.6	2.47	44.9	182	38
45 Weeks	23'00	107.7	2.75	45.8	185	52	21'00	78.3	2.49	43.7	176	41	22'00	75.8	2.29	41.6	177	36
50 Weeks	23'30	103.3	2.85	47.5	188	48	21'00	77.0	2.38	41.8	178	42	23'00	89.6	2.27	41.3	180	41

Results of Maximal Test.

表29. 50週間歩行トレーニングの進行にともなう最大酸素摂取量測定結果.

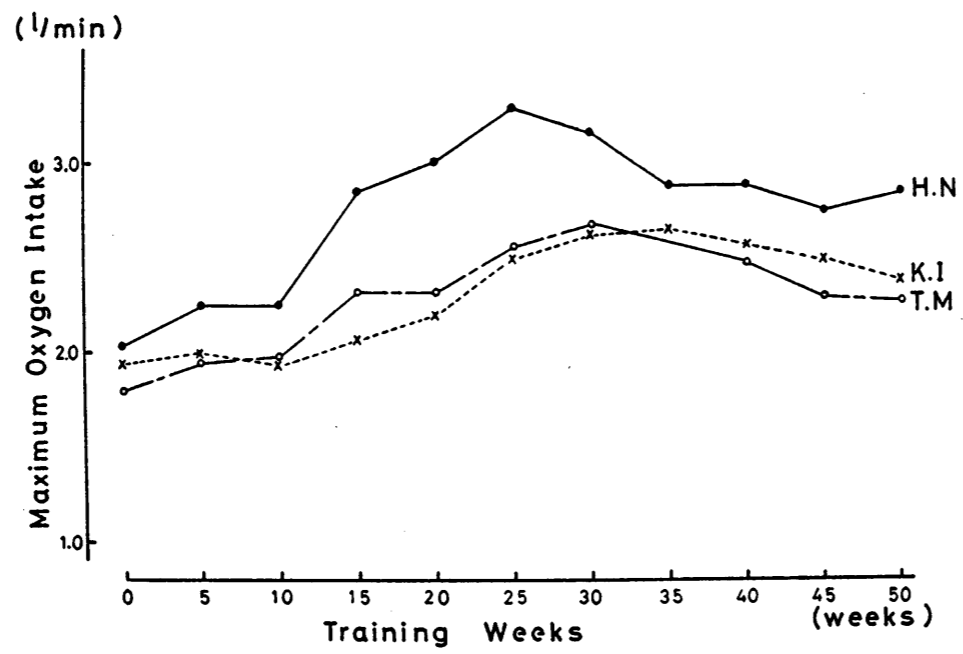


図 82. 50週間歩行トレーニングによる
最大酸素摂取量の変動。

Subject Training Weeks	H.N.	K.I.	T.M.
Before Training	$Y = 0.0149X - 0.5337$	$Y = 0.0175X - 0.8130$	$Y = 0.0131X - 0.6437$
10 Weeks	$Y = 0.0161X - 0.5320$	$Y = 0.0203X - 1.0752$	$Y = 0.0151X - 0.6806$
20 Weeks	$Y = 0.0216X - 1.1602$	$Y = 0.0170X - 0.6119$	$Y = 0.0166X - 0.5754$
30 Weeks	$Y = 0.0194X - 0.7535$	$Y = 0.0178X - 0.6297$	$Y = 0.0213X - 1.1084$
40 Weeks	$Y = 0.0186X - 0.5969$	$Y = 0.0170X - 0.7107$	$Y = 0.0169X - 0.4580$
50 Weeks	$Y = 0.0195X - 0.9274$	$Y = 0.0170X - 0.5669$	$Y = 0.0172X - 0.6453$
30-50 Weeks	$Y = 0.0186X - 0.6643$	$Y = 0.0170X - 0.5909$	$Y = 0.0176X - 0.6278$

Y: Oxygen Intake (l/min) X: Heart Rate (beats/min)

The regression equation on oxygen intake and heart rate during exercise.

表30. 50週向歩行トレーニングにともなう、運動中心拍数と酸素摂取量の関係

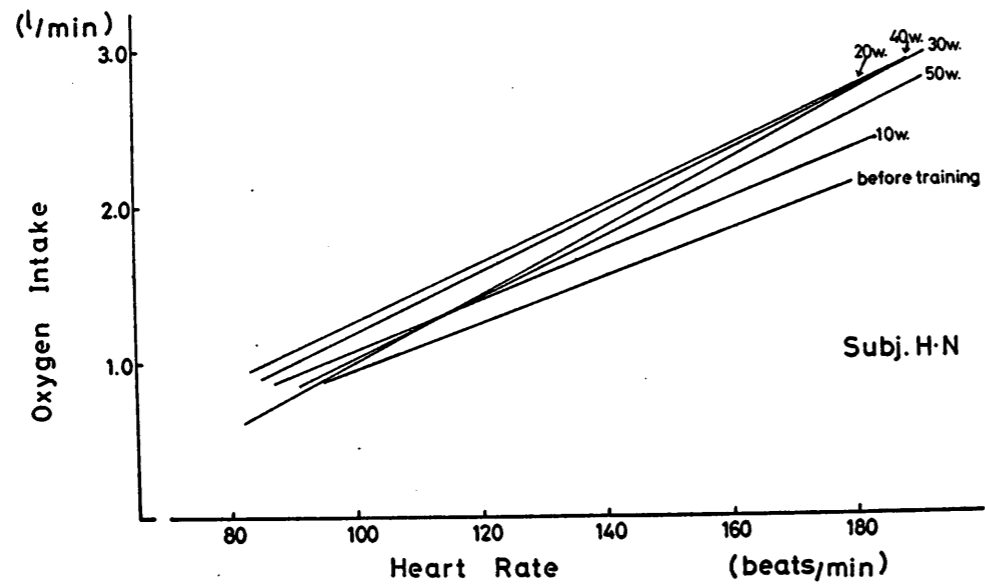


図83、運動中心拍数と酸素摂取量の関係。
(被検者 H.N)

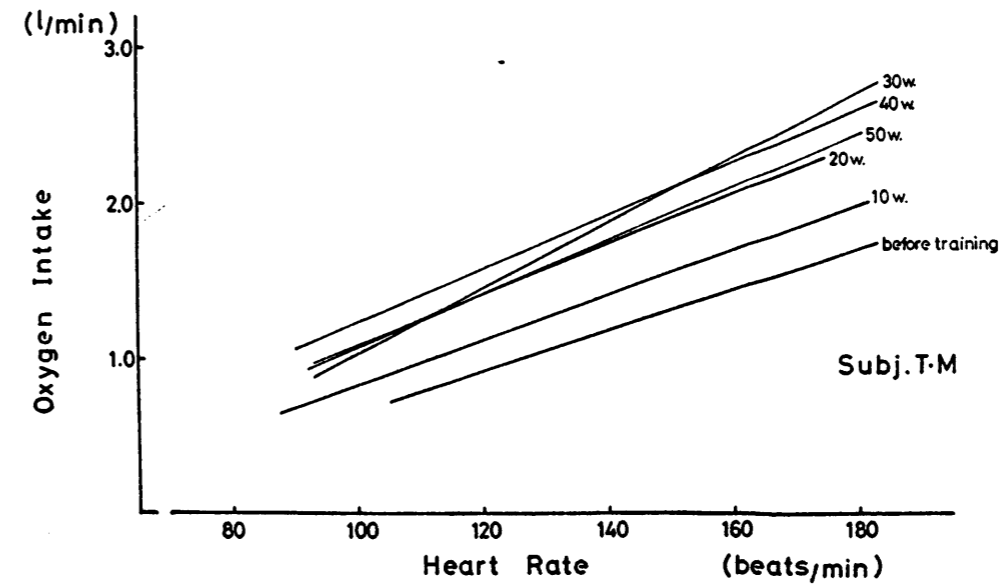


図84、運動中心拍数と酸素摂取量の関係。
(被検者 T.M)

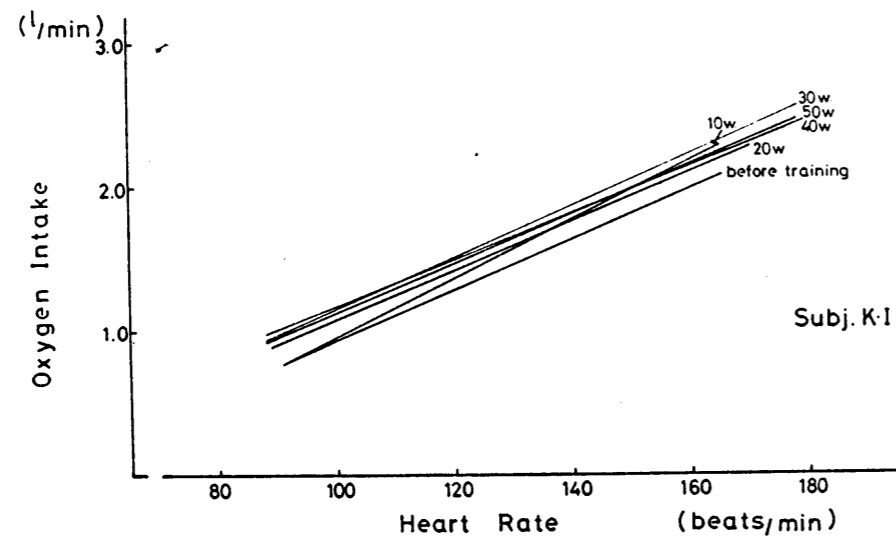


図85、運動中心拍数と酸素摂取量の関係。
(被検者 K.I)

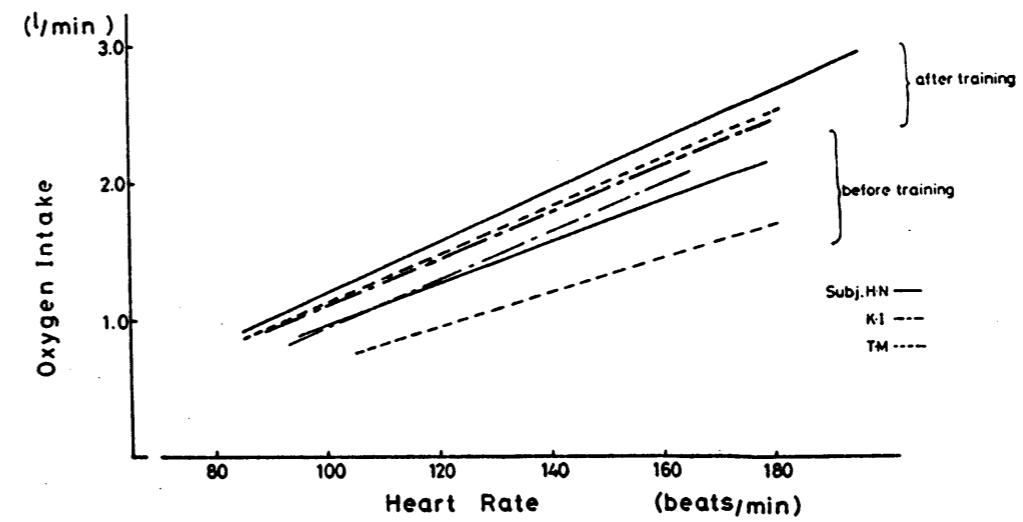


図86、運動中心拍数と酸素摂取量の関係。
(総括図)

		Subject		
		HN	KI	TM
Heart rate level (beats/min) 120	Before T.	(ml/beat) 10.5	10.7	7.7
	After T.	13.1 (+25.8 %)	12.1 (+13.1 %)	12.4 (+61.0 %)
170	Before T.	11.8	12.7	9.3
	After T.	14.7 (+24.6 %)	13.5 (+6.3 %)	13.9 (+49.5 %)

表31. 回帰方程式から求めた トレーニング前後の酸素脈の比較.

Subject		H.N.			K.I.			T.M.		
Training Period		A	B	C	A	B	C	A	B	C
		Mean (S.D)	Mean (S.D)	Mean (S.D)	Mean (S.D)	Mean (S.D)	Mean (S.D)	Mean (S.D)	Mean (S.D)	Mean (S.D)
Fixed Load 30 %	\dot{V}_e (l/min)	29.09 (0.84)	29.17 (1.74)	27.88 (0.77) ** (*)	25.76 (0.82)	26.71 (0.75)	26.28 (0.67) n.s (n.s)	24.89 (1.17)	28.91 (1.35)	28.52 (1.60) n.s (n.s)
	\dot{V}_{O_2} (l/min)	1.16 (0.06)	1.16 (0.04)	1.11 (0.03) ** (**)	0.95 (0.04)	0.96 (0.03)	0.89 (0.06) * (**)	1.05 (0.06)	1.13 (0.04)	1.03 (0.08) n.s (**)
	H.R. (beats/min)	105.70 (6.72)	103.10 (4.03)	96.10 (3.35) ** (**)	91.70 (5.31)	93.70 (6.32)	90.10 (3.07) n.s (n.s)	96.30 (3.60)	103.70 (6.53)	98.20 (6.06) n.s (*)
Fixed Load 50 %	\dot{V}_e (l/min)	40.01 (1.43)	41.30 (0.99)	39.34 (3.17) n.s (*)	30.49 (1.38)	29.76 (0.66)	30.58 (1.57) n.s (n.s)	27.49 (1.36)	28.90 (1.22)	28.34 (1.62) n.s (n.s)
	\dot{V}_{O_2} (l/min)	1.65 (0.05)	1.68 (0.04)	1.60 (0.06) * (**)	1.12 (0.05)	1.11 (0.06)	1.03 (0.04) ** (**)	1.15 (0.08)	1.17 (0.14)	1.06 (0.06) ** (**)
	H.R. (beats/min)	127.00 (5.14)	127.10 (4.23)	119.89 (5.23) ** (**)	105.00 (3.10)	101.50 (3.29)	100.90 (4.47) ** (n.s)	100.30 (1.93)	105.80 (3.65)	96.30 (3.77) n.s (**)
Fixed Load 70 %	\dot{V}_e (l/min)	61.64 (4.09)	65.35 (4.82)	58.02 (4.35) ** (**)	41.99 (0.94)	41.35 (3.59)	41.03 (1.92) n.s (n.s)	48.68 (5.67)	45.68 (1.42)	46.08 (2.32) n.s (n.s)
	\dot{V}_{O_2} (l/min)	2.36 (0.08)	2.34 (0.11)	2.20 (0.06) ** (**)	1.71 (0.12)	1.58 (0.13)	1.53 (0.06) ** (*)	1.74 (0.10)	1.72 (0.06)	1.60 (0.08) ** (**)
	H.R. (beats/min)	160.30 (4.63)	163.00 (6.65)	150.80 (8.09) ** (**)	124.30 (3.97)	122.90 (5.13)	119.00 (2.83) ** (*)	146.60 (3.37)	137.60 (3.38)	131.10 (1.95) ** (**)

*: $p < 0.05$ **: $P < 0.01$ ** : Between A and C. (**): Between B and C.

A: 15, 20 Weeks. B: 25, 30, 35 Weeks. C: 40, 45, 50 Weeks.

Results of Submaximal Test. The mean values of ventilation, oxygen intake and heart rate in the steady state during 20 minutes walking at the fixed load.

表 32. 最大下一定負荷テストにおける 定常状態時の生体反応.

Subject	Age (years)	Body Height (cm)	Body Weight (kg)	Exhaustive Time (min)	Total Work (kgm)	\dot{V}_e max. (STPD) (l/min)	$\dot{V}O_2$ max. (l/min)	$\dot{V}O_2$ max./W (ml/kg.min)	Max.H.R. (beats /min)	Max.R.R. (freq. /min)	Oxygen Pulse (ml/beat)
K.U.	32	158.0	48.0:47.5	6:6	2700:2700	56.4:52.4	1.69:1.46	35.1:30.8	179:175	51:48	9.4:8.4
H.O.	34	150.2	49.5:47.5	6:8	2700:3938	37.7:42.7	1.62:1.69	32.7:35.6	182:189	29:34	8.9:9.0
S.A.	34	152.6	43.0:43.0	5:6	1950:2262	34.1:38.2	1.26:1.25	29.3:29.1	174:189	40:40	7.2:6.6
S.E.	35	155.9	53.0:50.5	4:4	1500:1500	31.2:43.4	1.26:1.22	23.7:24.2	164:174	28:40	7.7:7.3
T.S.	35	153.7	49.5:50.0	7:7	3300:3375	54.0:47.8	1.74:1.52	35.1:30.3	171:166	49:46	10.2:9.1
K.M.	36	151.2	53.0:53.0	6:6	2400:2400	49.7:54.4	1.57:1.59	29.7:29.9	174:177	39:41	9.0:9.0
K.W.	37	155.3	56.5:56.5	7:7	3375:3375	57.2:56.2	1.74:1.53	30.8:27.1	172:175	43:43	10.1:8.7
M.A.	37	154.0	58.0:54.0	6:7	2700:3300	60.8:73.5	1.58:1.61	27.3:29.8	180:188	47:54	9.5:8.8
K.O.	37	155.0	52.0:51.5	7:6	3375:2400	42.0:50.7	1.64:1.80	31.6:34.9	183:174	40:46	9.2:10.8
O.G.	37	151.7	45.0:45.5	5:6	1950:2700	37.9:49.8	1.27:1.33	28.3:29.2	173:172	41:46	7.4:7.7
T.U.	37	158.0	52.0:51.0	7:8	3000:3900	47.5:59.9	1.70:1.70	32.6:33.3	178:176	45:43	9.5:9.7
I.S.	37	157.1	48.0:46.0	6:6	2700:2700	49.6:60.5	1.40:1.47	29.1:32.1	170:179	39:42	8.2:8.2
Y.A.	38	154.2	58.0:56.5	6:7	2700:3375	51.4:65.4	1.63:1.56	28.1:27.5	179:181	35:43	9.1:8.9
A.O.	38	158.0	67.0:64.5	7:8	3375:4100	50.6:52.9	1.87:1.88	27.9:29.3	175:180	35:37	10.8:10.5
Mean	36.0	154.6	52.3:51.2	6.1:6.6	2675:3002	47.2:53.4	1.57:1.54	30.1:30.2	175:178	40:43	9.0:8.8
S.D.	1.69	2.51	5.93:5.35	0.9:1.1	565:717	8.82:9.05	0.19:0.19	3.03:2.94	5.1:6.5	6.6:4.7	1.1:1.1
O.K.	40	150.8	43.5:42.5	5:6	1950:2475	37.3:49.7	1.22:1.24	28.1:29.4	178:173	46:50	7.1:7.2
M.U.	41	151.0	56.0:54.0	6:5	2700:2100	41.2:45.3	1.48:1.40	26.2:25.9	168:170	36:39	8.7:8.2
S.I.	43	161.3	57.0:56.5	6:7	2700:3000	43.0:64.5	1.35:1.52	23.7:26.9	170:179	43:54	7.9:8.5
I.T.	44	150.3	51.5:51.0	7:7	3300:3300	43.2:43.5	1.57:1.61	30.5:31.6	169:160	39:32	8.9:9.6
Y.U.	45	152.0	65.0:61.5	4:5	1500:1950	33.6:36.1	1.47:1.49	22.6:24.2	180:177	31:34	8.2:8.4
S.U.	46	151.0	48.0:46.0	5:6	1950:2400	36.3:48.7	1.20:1.37	25.1:29.9	175:172	27:48	6.9:8.4
H.A.	47	162.4	59.0:57.0	6:6	2700:2700	56.4:59.2	1.50:1.56	25.4:27.4	149:161	30:34	10.3:9.7
K.Y.	50	156.7	60.5:61.5	5:4.4	2100:1750	36.2:39.1	1.45:1.26	23.9:20.4	148:160	28:33	9.8:7.9
Mean	44.5	154.4	55.1:53.8	5.5:5.8	2362:2459	40.9:48.3	1.41:1.43	25.7:27.0	167:169	35:41	8.5:8.5
S.D.	3.0	4.68	6.56:6.45	0.9:0.9	545:494	6.7:9.0	0.13:0.13	2.41:3.32	11.5:7.2	6.7:8.3	1.1:0.8

* Before Training : After Training.

* \dot{V}_e max.;Maximum Ventilation. $\dot{V}O_2$ max.;Maximum Oxygen Intake.

$\dot{V}O_2$ max./W.;Maximum Oxygen Intake per Body Weight. Max.H.R.;Maximum Heart Rate.

Max.R.R.;Maximum Respiratory Rate.

表 33. 家庭婦人の体カづくりサークル活動 参加前後の最大酸素摂取量 測定結果の比較.