

総説

日本人の体力の最近10年間における変化傾向と現状

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Review

Annual changing trend of physical fitness of Japanese in the recent 10 years and its present status

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文部省による国民の体力調査は10歳から29歳までの青少年に対しては1964年から、30歳から59歳までの壮年者に対しては1967年から現在まで毎年実施され体力・運動能力調査報告書として報告されている。従って、青少年については30年間、壮年者については27年間の体力の逐年変化を見る事が出来る。青少年の身長、体重等の体格では1970年代前半頃まで発育加速化現象と云われたように急激は増大が見られたが、以後ほぼ1940年以前の漸増傾向と同程度の勾配で現在もお増大が見られている。しかし、体力、運動能力では発育加速化現象の生起していた期間では発達加速化現象とでも云えるような顕著な向上傾向が出現していたが、以後は柔軟性、持久力のように一貫して低下を示すもの、及び敏捷性、瞬発力のように体格と同様な向上傾向を示しているものがある。最近10年間の逐年変化傾向を見ると、年齢・性によって差異はあるが、青少年男子では背筋力のみが向上傾向を示してをり、他の体力・運動能力要素では低下か停滞傾向が見られる。これに対し、女子では10歳で背筋力が向上傾向を示している以外は、低下か停滞傾向を示している。かかる逐年変化傾向から、1993年度では1964年度より低下してしまっている体力要素さえ見られる。現在の青少年体力の特徴を30年間の平均値の平均値と標準偏差を利用して描いたプロフィールから見ると、年齢によって差異はあるが、概して敏捷性、瞬発力、体力一般には優れ、筋力、筋持久力、柔軟性、持久力、投力、跳力および運動能力一般には劣ると云う特徴が見られる。壮年では持久力が顕著に他の体力要素より劣り、他の体力要素は概してバランスがとれていると考えられる。

Key words : physical fitness, Japanese children and youth, Japanese elderly, Annual changing trend, physical fitness profile

Introduction

National survey of physical fitness was initiated in 1964 for children and youth and in 1967 for the elderly by Ministry of Education, Science and Culture and has been carried out and reported annually, so the data have been accumulated for 30 years in children and youth and 27 years in the elderly. Matsuura (1993) analyzed the annual changing trends of stature and body

weight in the term over 1900 and 1990 and reported that the stature and body weight of children and youth completed to catch up the prewar trend in 1950's for most of ages and both sexes, and so-called growth acceleration phenomenon finished in the first half of 1970s and thereafter, same gradual increasing trend as found in the prewar ; before 1940, is still continuing up to today. In the same study, Matsuura (1993) also reported that some rapid improvement was found in most domains of physical fitness and motor ability

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in the term in which growth acceleration phenomenon took place. He also pointed that such a rapid improvement in physical fitness and motor ability might be called developmental acceleration phenomenon. For the elderly Matsuura (1993) pointed that same gradual increasing trend as found in the children and youth was observed in physique and also some degree of improvement or stagnation trend was found in most of physical fitness domains except endurance. What status of physical fitness children and youth and the elderly have reached at present through such annual changing trend is investigated in this paper. Annual changing trends are influenced by various socio-economical conditions, habits of meal, practice of exercises, overall life style of people and so on. Therefore, annual changing trends may suggest what problems people are facing in their physical fitness and what the key solutions are. Then in this paper, annual changing trends of physical fitness were over-viewed in Japanese

children and youth and the elderly, and the changing trends of their physical fitness for recent 10 years were investigated and then their present status of physical fitness were discussed.

Method and procedures

The annual data of physical fitness and motor ability of children and youth were filed as data base by the author himself in 1985 grant-in-aid for scientific research (A), and since then this data base have been up-dated every year by adding new data sets reported in the report of physical fitness and motor ability published by Ministry of Education, Science and Culture. This data base includes the physical fitness data with age increase for children and youth aged 10 through 20, young workers aged 18 through 29, and the elderly aged 30 through 59, and also the data sets to investigate annual trend of each item in each sex and each age, respectively. The data filed in this data base were used to investigate the

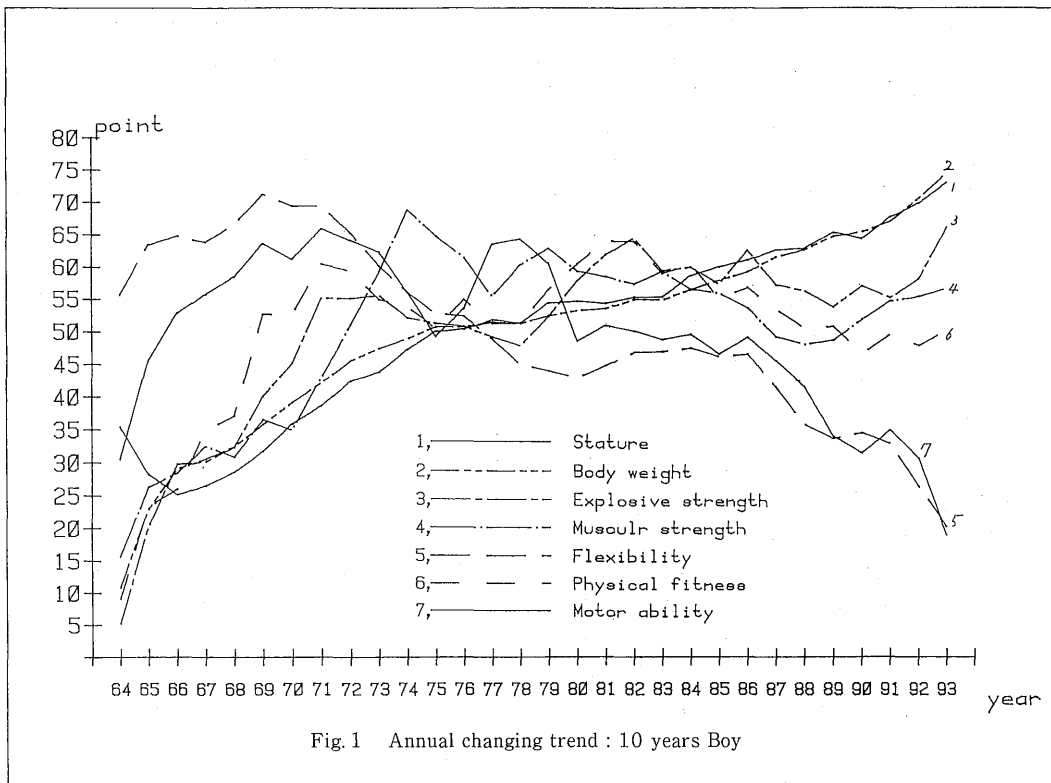
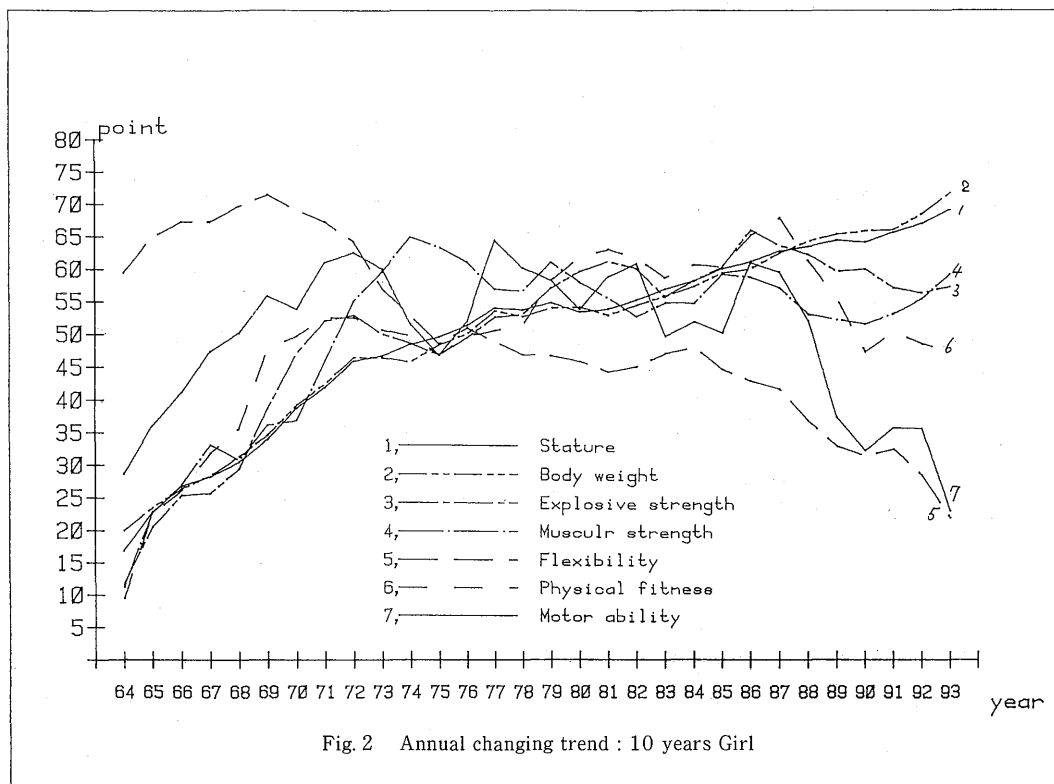


Fig. 1 Annual changing trend : 10 years Boy



problems taken up in this paper.

For comparison in annual trend between different items of physical fitness, the annual data of each item were converted to H-score using the mean and standard deviation of annual data of each items ; 1964 to 1993 for children and youth, and 1967 to 1993 for the elderly, because H-score ; $H = 50 + 14Z$ where Z stands for standard score, can accentuate the change more than standard score and T-score ; $T = 50 + 10Z$, and comparison can be worked out between different measures. The gradient of changing trend for recent 10 years ; 1984 to 1993, was evaluated by the grade of straight line fitted the H-score data of 10 years by least square procedure. Thus, these grades could be compared between different items of physical fitness.

Results and Discussion

1 Overview of annual trend of physical fitness

Fig. 1 and Fig. 2 show the annual changing

trends of 7 elements of physical fitness and motor ability for boys and girls aged 10 ; stature, body weight, explosive strength measured by vertical jump, muscular strength by back strength, flexibility by trunk flexion, physical fitness in general evaluated by total point of physical fitness test, and motor ability by total point of motor ability test. The annual trends of all measures were not shown in these figures, because the figures might be too complicated to investigate the trends. Up to before half of 1970s, stature and body weight increased very rapidly but such sharp increasing trend ceased in middle of 1970s, and then slow increasing trend still continue up to today. In boys, however, this increasing trend seems to be accelerated since 1980, because the trend curves of stature and body weight are concave upward since 1980. But this trend can not be observed in girls. The rapid improvement is found in most of physical fitness and motor ability measures up to around 1972 in both sexes, although a certain

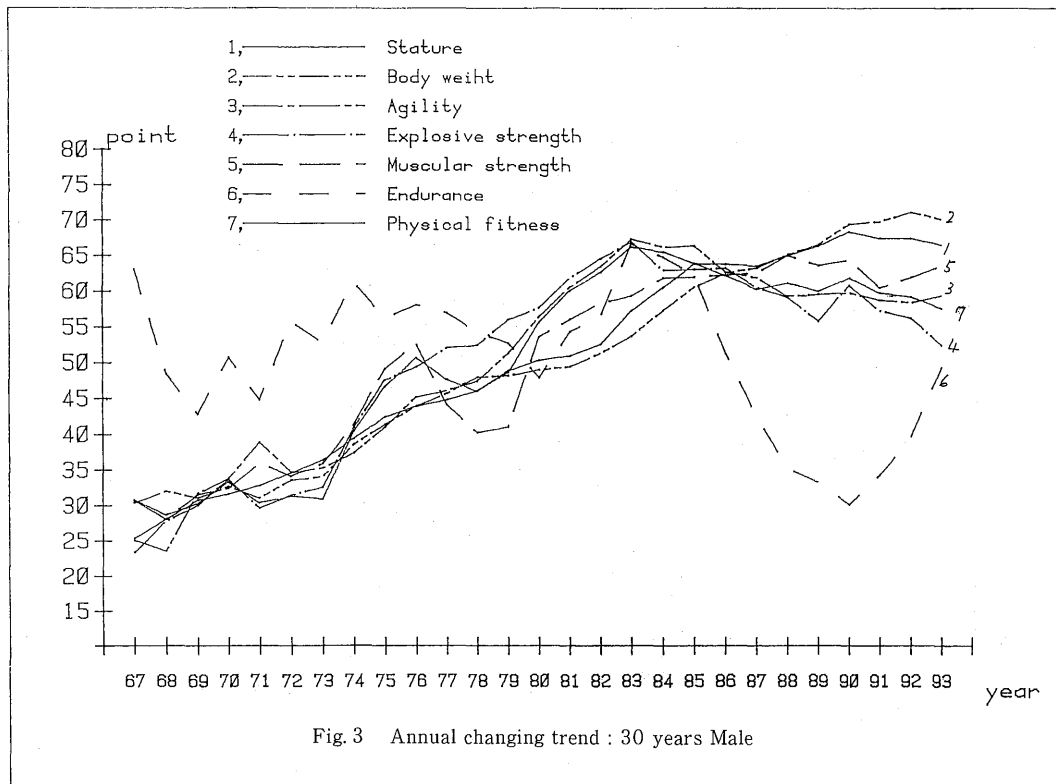
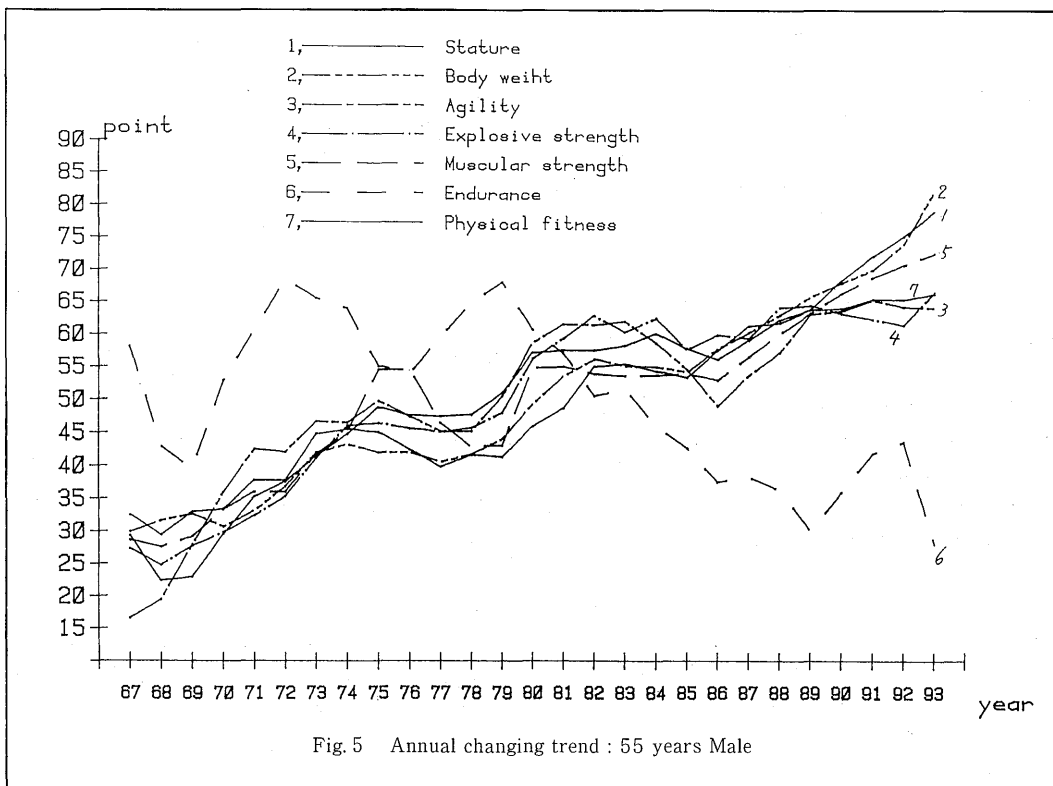
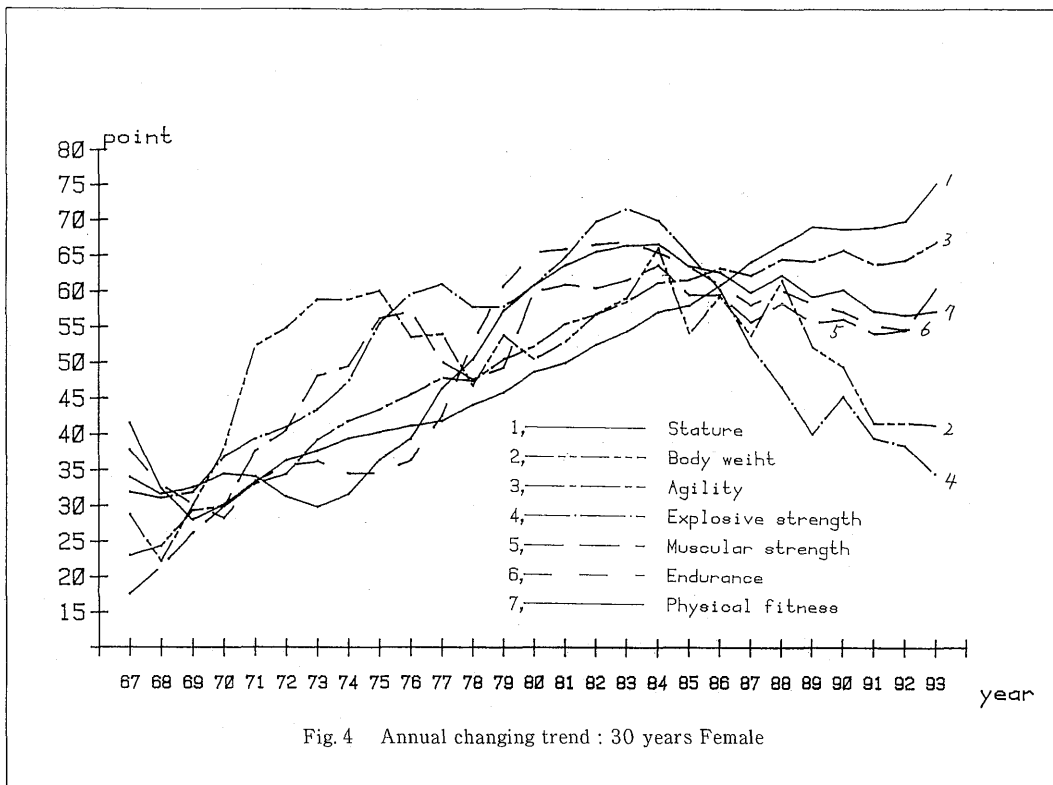


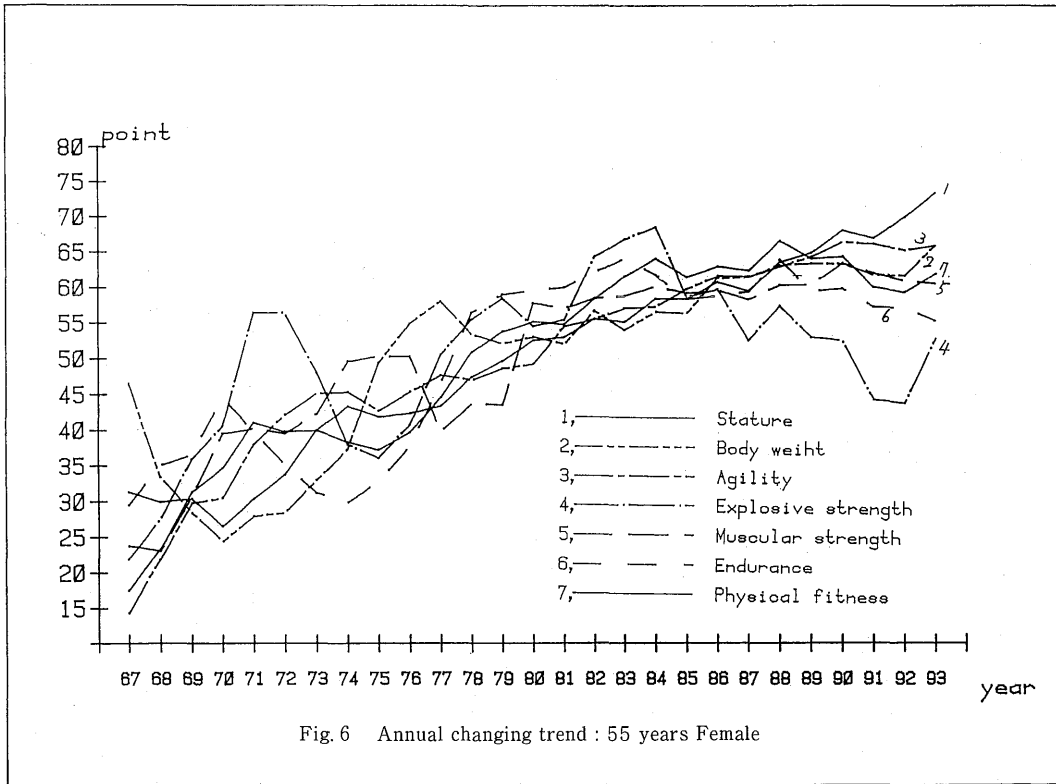
Fig. 3 Annual changing trend : 30 years Male

decreasing trend appears before 1972 in a few measures ; such as flexibility and motor ability in boys and flexibility in girls. Therefore, it can be inferred that the same kind of acceleration trend as turned up in stature and body weight up to around 1975 appeared in most of physical fitness and motor ability measures as well. However, since then a certain degree of deterioration seems to continue up to today in flexibility and motor ability in general for boys. Particularly in recent years, such deterioration seems to be considerably sharp, as the Fig. 1 shows. But some degree of stationary trend seems to continue in the other measures. In girls the similar trends can be inferred roughly. Then, the present status of physical fitness is that most of physical fitness and motor ability measures are inferior to status of physique and especially motor ability and flexibility are considerably inferior to other measures of physical fitness in boys and girls aged 10.

Fig. 3 and 4 show the annual trends of 7

physical fitness measures ; stature, body weight, agility measured by side step, explosive strength by vertical jump, muscular strength by grip strength, endurance by 1500m fast walk for male and 1000m for female, of male and female aged 30, and Fig. 5 and 6 show the annual changing trends of same physical fitness measures for male and female aged 55. Up to around 1985, some kind of definite increasing trends appeared in most physical fitness measures, except endurance in male and body weight in female. Thereafter, stature and body weight still continue to increase in slower rate but other measures seem to be in stationary trend, except endurance which show a certain rapid deterioration trend up to 1990 and thereafter, an improvement trend. In female stature which shows a certain consistent increasing trend from 1970 until today shows a quite different changing trend from body weight which shows a rapid increase trend up to before half of 1970s and then a decreasing one in a few years





and then an increasing one in a few years up to 1984 and thereafter an definite decreasing trend up to today. Except body weight and explosive strength which show decreasing trend in recent years and stature which shows a definite increasing trend, other measures of physical fitness show a certain stationary trend since around 1984. Thus, the male aged 30 shows such characteristics of physical fitness that endurance is inferior to physique and other measures, and the female shows such characteristics that body weight and explosive strength are inferior to stature and other measures. In the male aged 55, most of physical fitness measures show the same annual trend as the physique measures show, except endurance which shows a distinct deterioration trend since 1980. In the female aged 55, most of physical fitness measures show such trends that are comparatively sharper improvement trend up to 1985 and thereafter stationary or slow increasing one, except explosive strength

which show a definite deterioration trend since 1984. Therefore, the present female aged 55 seems to be balanced in physical fitness among physique and physical fitness elements except explosive strength. In male, endurance is very much inferior to other physical fitness measures and physique, but explosive is a little inferior to others in female. This characteristics may be also found in male and female aged 30.

2 Mean annual trend of physical fitness in recent 10 years ; 1984 to 1993

Table 1 and 2 show the grades of straight line fitted the annual H-score data of last 10 years. All data were converted to H-score, so these grades can be compared between different measures. In these tables those aged 18 are college boy and girls. In boys and girls aged 10, 13 and 16, all the physique measures show positive grades ; i. e., physique still continue to become larger gradually year by year. In boys aged 18,

Table 1 Mean gradients for recent 10 years in annual changing trends of physical fitness-Boy ; 1984 through 1993

Item \ Age	10	13	16	18
Stature	1.516*	1.310*	1.123*	0.236
Body weight	1.867*	2.044*	1.619*	0.187
Chest girth	2.476*	2.370*	1.163*	-1.054*
Sitting height	2.578*	1.676*	1.973*	-3.174**
Side step	-0.234	0.083	-0.376	-0.939
Vertical jump	0.227	0.293	0.105	-0.781
Back strength	0.628	2.156*	1.090*	-2.317*
Grip strength	0.026	0.073	-1.459*	-3.435**
Trunk extension	-1.123*	-3.332*	-2.497*	-3.229**
Trunk flexion	-2.810*	-3.332**	-2.497*	-3.229**
P.F. test score	-0.898	-0.403	-0.896	-3.031**
50m sprint	-1.397*	0.847	1.759*	-2.609*
Running long jump	-2.776*	-1.120*	-1.542*	-2.982*
Ball throw	-2.905*	-0.063	-1.933*	-4.058**
Pull-ups	-2.522*	-0.978	-2.507*	-5.051**
Endurance run	****	-2.493*	-4.022**	-3.853**
M.A. test score	-2.839*	-0.614	-2.172*	-4.650**

Note, 1), The boys of 18 years old are college boys.

2), P.F. test scores stands for Physical fitness test score and M.A. test score for Motor ability test score.

3), Endurance run is not given to the boys and girls of elementary school.

4), * means significant at $p < 0.05$ and ** at $p < 0.01$

Table.2 Mean gradients for recent 10 years in annual changing trends of physical fitness-Girl ; 1984 through 1993

Item \ Age	10	13	16	18
Stataure	1.057*	1.104*	0.920	0.307
Body weight	1.356*	1.258*	1.571*	-0.856
Chest girth	1.375*	1.770*	2.974*	1.110*
Sitting height	1.543*	2.349*	2.318*	-0.211
Side step	-2.143*	-1.348*	-1.285*	-0.531
Vertical jump	-0.475	-0.330	-0.273	-0.133
Back strength	1.250*	0.194	-0.645	-2.337*
Grip strength	-0.223	-2.197*	-3.155**	-2.892*
Trunk extension	-1.374*	-1.454*	-2.588*	-2.693*
Trunk flexion	-2.641*	-3.414**	-3.265**	-4.111**
P.F. test score	-1.841*	-2.209*	-2.901*	-1.932*
50m sprint	-0.064	0.377	0.068	-0.866
Running long jump	-2.718*	-1.798*	-2.411*	-2.045*
Ball throw	-4.056**	-3.971**	-3.166**	-2.104*
Pull-ups	-2.014*	0.113	-0.461	-0.643
Endurance run	*****	-1.518*	-1.275*	-0.933
M.A. test score	-2.772*	-1.483*	-2.366*	-2.360*

Note, 1), The girls of 18 years old are college girls.

2), P.F. test scores stands for Physical fitness test score and M.A. test score for Motor ability test score.

3), Endurance run is not given to the boys and girls of elementary school.

4), * means significant at $p < 0.05$ and ** at $p < 0.01$

Table 3 Mean gradients for recent 10 years in annual changing trends of physical fitness-Male ; 1984 through 1993

Item \ Age	30	35	40	45	50	55
Stature	0.585	1.460*	2.175*	2.779*	1.707*	2.937*
Body weight	1.490*	1.293*	1.878*	2.013*	1.935*	2.854*
Chest girth	0.390	0.063	-0.073	0.801	1.497*	1.949*
Side step	-0.178	0.873	1.703*	0.786	-0.036	0.548
Vertical jump	-1.037*	0.824	2.078*	1.518*	0.722	1.269*
Grip strength	-1.101*	-0.113	0.567	0.108	0.072	0.428
Zigzag run	-0.097	0.609	0.345	0.856	1.540*	2.176*
Fast walk	-3.254**	-2.943*	-0.278	-1.618*	-1.952*	-0.765
P.F.test score	-0.797	0.407	1.068*	0.510	0.409	0.783

Note, 1), P.F.test score stands for Physical fitness test score.
 2), * means significant at $p < 0.05$ and ** at $p < 0.01$

Table 4 Mean gradients for recent 10 years in annual changing trends of physical fitness-Female ; 1984 through 1993

Item \ Age	30	35	40	45	50	55
Stature	1.738*	2.088*	2.629*	2.466*	1.864*	1.788*
Body weight	-2.335*	-2.379*	1.219*	1.392*	0.105	0.898
Chest girth	-0.976	-1.371*	-0.520	-1.477*	-3.115**	-2.296*
Side step	-0.578	0.765	0.972	1.076*	0.065	-0.066
Vertical jump	0.379	1.433*	0.599	0.785	0.805	0.929
Grip strength	-4.068**	-1.946*	-1.649*	-1.682*	-1.723*	-2.079*
Zigzag run	-0.886	-0.286	-0.442	0.872	1.070*	0.487
Fast walk	-1.284*	-1.837*	-1.623*	-0.416	-1.273*	-0.487
P.F.test score	-1.155*	-0.353	-0.423	0.355	-0.121	-0.427

Note, 1), P.F.test score stands for Physical fitness test score.
 2), * means significant at $p < 0.05$ and ** at $p < 0.01$

however, their stature and body weight tend to be in stationary changing trend but chest girth and sitting height are likely to decrease, and in girls aged 18, only chest girth seems to increase and other measures are likely to be in stationary changing trend. In agility measured by side step and explosive strength by vertical jump, boys show small grades showing the stationary trend but girls show negative and significant grades in agility, so it can be inferred that agility is lowering recently in girls but not in boys. Explosive strength shows stationary trend in both boys and girls. Muscular strength measured by back strength show a certain improvement in boys aged 13 and 16 and in girls aged 10, and a definite deterioration in boys and girls aged 18. In boys and girls aged 18, muscular strength measured by grip strength also show a definite lowering trend. In all ages and both sexes, flexibility measured by both trunk flexion and extension shows a distinct deterioration trend. In running ability measured by 50m sprint, girls of all ages show stationary trend but the boys aged 10 and 18 show a definite deterioration trend and those aged 16 show a certain improvement trend and those aged 13 stationary one. In jumping ability measured by running long jump, both boys and girls show similar distinct lowering trend as found in flexibility. In throwing ability measured by ball throw for distance, boys aged 10, 16 and 18 and girls of all ages show distinct deterioration trend, and only boys aged 13 show stationary trend. In muscular endurance measured by pull-ups, boys aged 10, 16 and 18 show distinct trend of deterioration but those aged 13 show somewhat stationary trend or deterioration of slight degree, because its grade is -0.978. The grade of boys aged 18 was -5.051. This value is the highest value in all measures. Therefore, it can be concluded that muscular endurance of boys aged 18 ; college boys, is seriously lowering in recent years. In girls, however, a distinct deterioration was found in age of 10 but stationary one in other ages. In endurance measured by 1500m run for boys and 1000m run for girls, a distinct deterioration trend was found in

both boys of all ages and girls aged 13 and 16. In girls aged 18, however, its grade was -0.933, so it can be inferred that stationary or deterioration of slight degree was found in girls aged 18. In motor ability in general evaluated by total point of motor ability test battery, boys aged 10, 16 and 18 and girls of all ages show distinct deterioration trend and boys aged 13 show some stationary trend. The number of measures which show deterioration is more in motor ability measures than in physical fitness measures in both sexes and all ages. Particularly in boys aged 18, negative grade was found in all measures of motor ability, although 5 measures of physical fitness were found negative in 7 measures. Thus, it can be concluded that measures showing negative grade are more in number than the ones showing positive. In other words, more measures of physical fitness and motor ability show distinct lowering trend in recent 10 years for both boys and girls of all ages. Particularly flexibility measured by both trunk flexion and extension is lowering in boys and girls of all ages and motor ability in general also is lowering in girls of all ages and boys aged 10, 16 and 18. Physical fitness in general also is lowering in girls of all ages but boys aged only 18. Jumping ability is also lowering in boys and girls of all ages. Throwing ability is lowering in boys aged 10, 16 and 18 and girls of all ages. Therefore, a gradual enlargement of physique is still continuing in boys and girls under 18 years old, but distinct deterioration trends are found in considerable number of domains of physical fitness and motor ability.

Table 3 and Table 4 show the grades of straight line fitted the physical fitness data of last 10 years ; 1984 through 1993, in the elderly people. For male the positive and significant grades are found in most measures of physique, so it can be inferred that the physique of the elderly is enlarging gradually year by year, as observed in the boys and girls under 18 years old. In female, however, negative and significant grades were found for the female aged 30 and 35. This means

that body weight of those aged 30 and 35 tends to decrease in recent 10 years. In these ages most of females would have to devote themselves to raise their children. That may be why such a decreasing trend would be found in these ages. In female aged 40s, however, positive and significant grades were found and grades which suggest stationary trend were found in those aged 50s. In stature, the grades suggest that the gradual increasing trend is continuing in all ages. Then, most grades of chest girth are negative and significant except 30 and 40 years of age, but the grade of those aged 30 is -0.976 and this suggests a little degree of lowering trend instead of stationary trend. Thus, taking the annual changing trends of stature, body weight and chest girth into consideration together, it can be inferred that the present female tends to become taller and slender.

In the male and female aged 30, negative grades were found in most of physical fitness measures, except explosive strength measured by vertical jump for female. This suggests that physical fitness of male and female aged 30 is lowering in recent 10 years, even though the grade of male's physical fitness in general evaluated by total point of physical fitness test is -0.797, which means a stationary trend. Particularly, deterioration trend is serious in endurance for male and muscular strength for female, as their grades suggest.

In both male and female, endurance shows negative grades in all ages, although they are not always significant, so it can be inferred that endurance show a certain deterioration trend in most ages. Then, negative and significant grades were found in all ages of female, so it can be concluded that muscular strength of female is on a distinct deterioration trend in recent 10 years.

3 Comparison in physical fitness and motor ability between the past and the present ; children and youth

Fig 7 shows the physical fitness and motor ability profile of boys and girls aged 10 in 1964, 1984 and 1993. As the profile drawn with real line shows, the present boys and girls show such characteristics that all domains of physical fitness and motor ability are inferior to domains of physique, but agility and explosive strength are not so much inferior to physique as the domains of motor ability. This is evidenced by that physical fitness in general (G. P. fitness) show higher profile score than fundamental motor skill (F. M. skill) and motor ability in general. Compared with the profile of 1964, the present boys and girls show much higher profile scores in two domains of physique ; i. e., the physique of present boys and girls have improved very much. The present boys and girls are significantly lower in

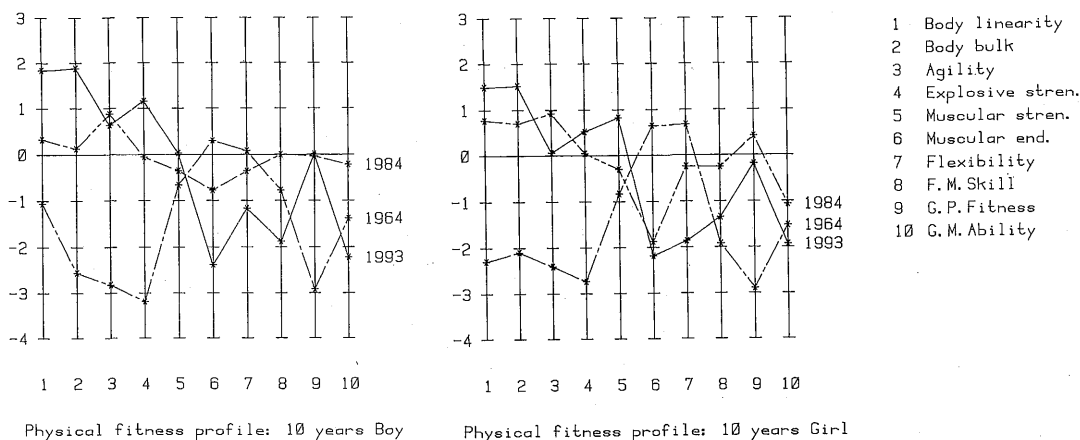


Fig. 7 Physical fitness profile : the boys and girls aged 10

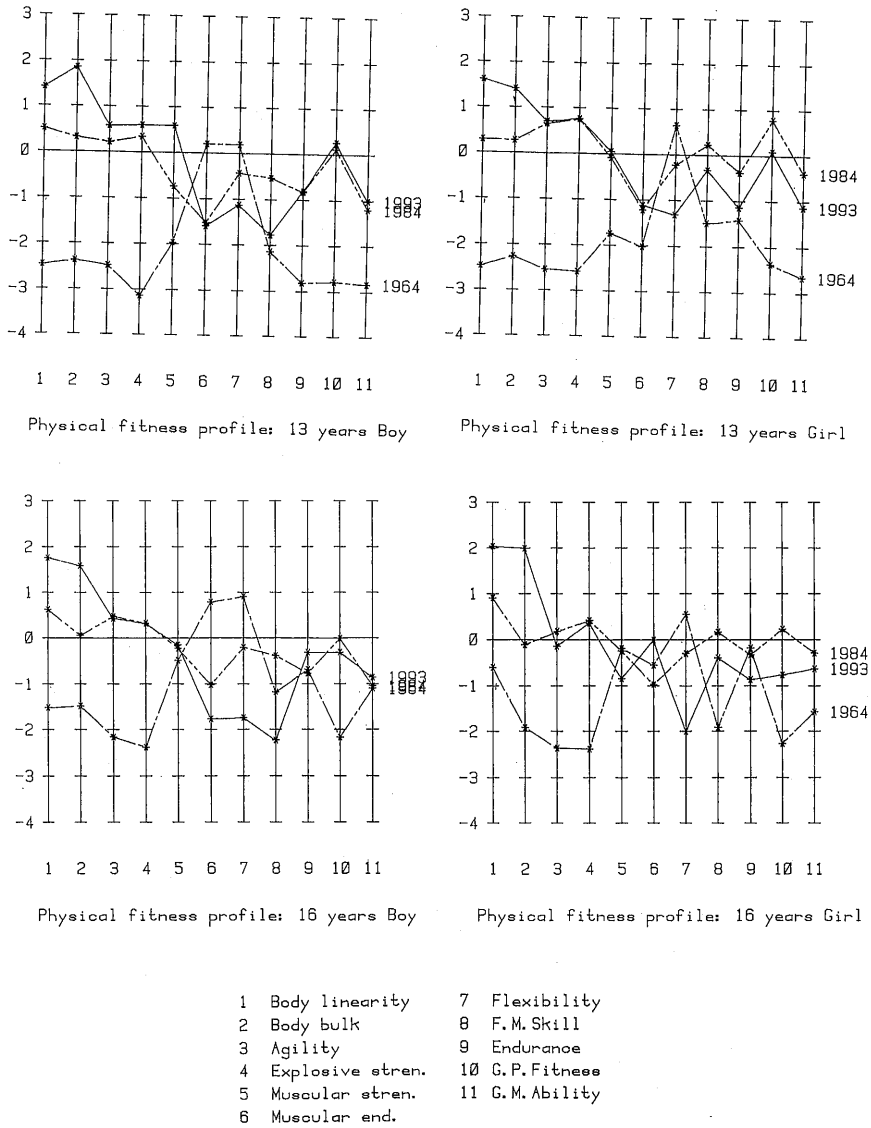


Fig. 8 Physical fitness profile : the boys and girls aged 13 and 16

profile scores of muscular endurance and flexibility and moreover, the boys are lower in even fundamental motor skill. Thus, it can be concluded that the present boys and girls aged 10 are inferior in physical fitness and motor ability for their physique and particularly their motor ability is very much inferior.

Fig. 8 and Fig. 9 show the physical fitness and motor ability profile of boys and girls aged over

13. As shown in the boys and girls aged 10, their physique domains are superior to all of physical fitness and motor ability domains. Particularly muscular endurance, flexibility and fundamental motor skill are very much inferior to physique. Above all, muscular endurance and flexibility are inferior to those of 1964 in boys. Agility and explosive strength domains are in better levels compared with other physical fitness

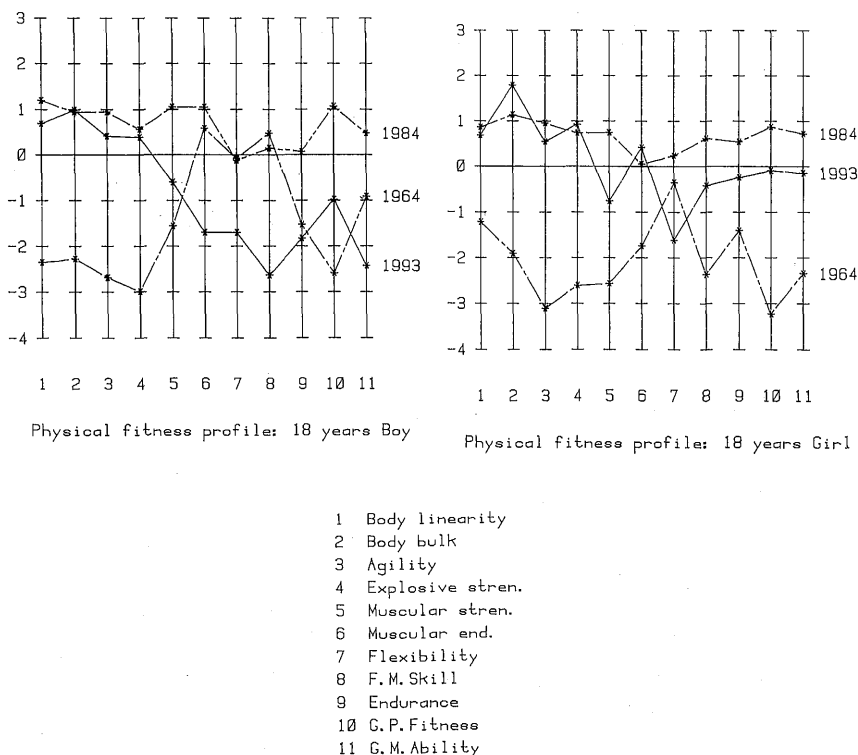


Fig. 9 Physical fitness profile : the college boys and girls aged 18

and motor ability domains, although they are worse in the level of profile than physique. While a great deal of improvement has been realized in these two domains since 1964, but such improvement seems to have ceased in middle of 1980s, because little differences were found in the profile score between 1984 and 1993. In girls, the trends are roughly the same as inferred in boys. Particularly, flexibility is significantly inferior to other physical fitness and motor ability domains. Roughly speaking, the present girls are superior in physical fitness and motor ability to those of 1964 but inferior to those of 1984, and as inferred in boys, all domains of physical fitness and motor ability are inferior to those of physique. Agility and explosive strength domains are rather superior to other domains of physical fitness and motor ability, although their relative levels are lower than those of physique, as mentioned in boys.

Fig. 10 and Fig. 11 show the physical fitness profile of the elderly people aged 30, 40 and 50 as representatives of the elder ages. It can be easily understood that endurance is very much inferior to other domains of physical fitness in both sexes and all ages. Except endurance, the profile is rather balanced between physique and physical fitness in male. In female, however, body bulk evaluated by body weight and chest girth is lower in profile score than body linearity evaluated by stature, so it can be concluded that the present female is taller but slender, as inferred previously in the mean gradients of annual changing trend of recent 10 years. In coordination and explosive strength, however, their profile scores are almost equal to those of physique domains in male and to body bulk domain in female. In other words, the present elderly people are rather stronger in agility and explosive strength than other domains of physical fitness ; i. e., they are strong at such abil-

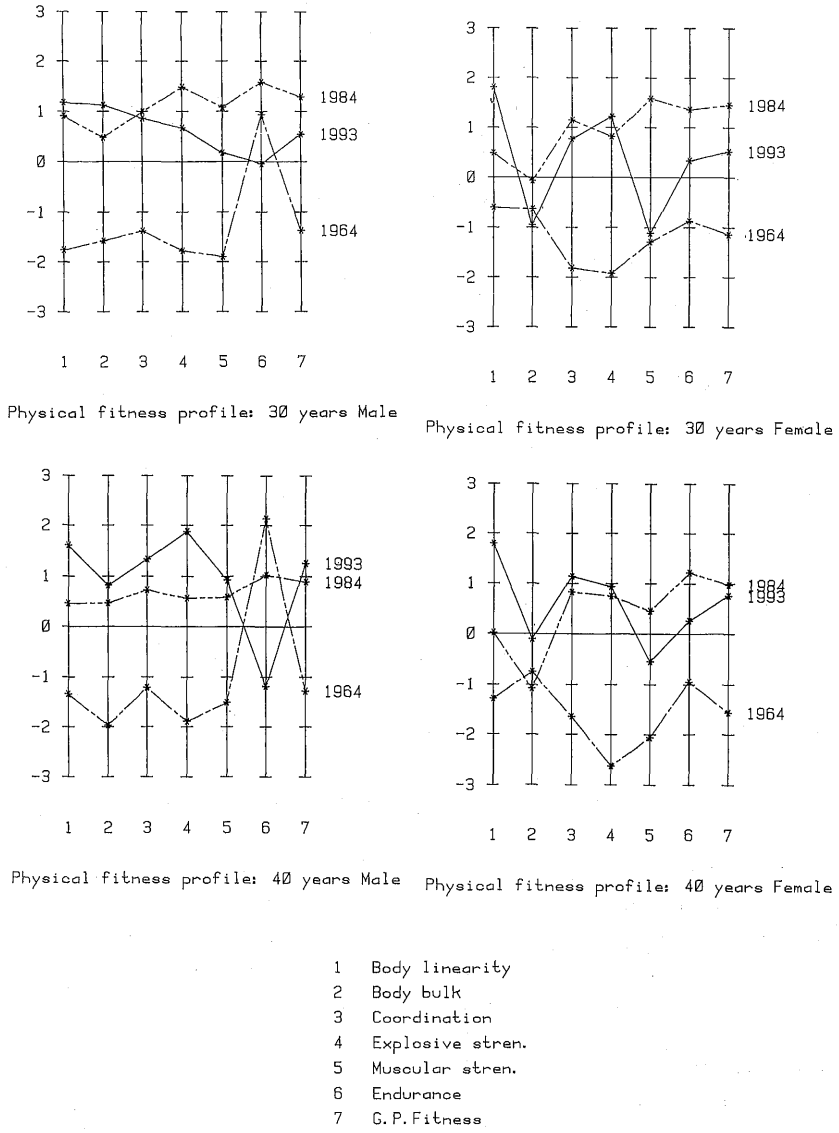


Fig. 10 Physical fitness profile : the male and female aged 30 and 40

ity as being exerted for a moment or fast and exactly. But they are very much weak at such ability as exerting continuously for a long time ; i. e., endurance. This is very significant in male. In female muscular strength is also weak. Compared with male and female of 1964, the present elderly people improved very much in physique, agility and explosive strength and physical fitness as whole but only endurance deteriorated in male,

but considerable degree of deterioration is found in body weight for only female aged 50 and other domains of physical fitness improved in even muscular strength in female. However, compared with those of 1984, significant deterioration is found in muscular strength and edndurance in female of all ages, but improvement is found in only body linearity.

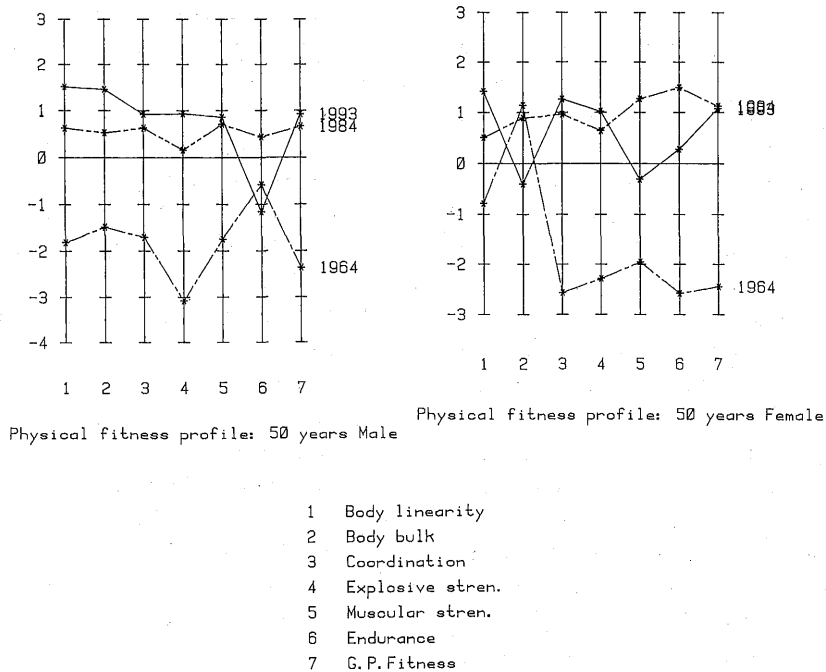


Fig. 11 Physical fitness profile : the male and female aged 50

4 Conclusion

The annual changing trends of physical fitness and motor ability were investigated for children and youth and those of physical fitness for the elderly people by over-viewing the standardized annual data sets, and investigating the grades of straight line fitted the standardized annual data sets by least square procedure, and investigating the physical fitness and motor ability profile. Then the following conclusions were induced.

1. Significant and gradual increasing trend of physique is still continuing in the boys and girls aged under 18.
2. In physical fitness and motor ability, a few elements showed similar degree of improvement as appeared in physique domains in both boys and girls and youth.
3. More numbers of measures showed a distinct deterioration trends in motor ability domains than in physical fitness domains for both boys and girls.
4. A certain deterioration trend was found in

most of physical fitness and motor ability domains for college boys and girls aged 18. Then, their deterioration gradients were larger than those of other ages.

5. Flexibility evaluated by both trunk flexion and extension showed a certain significant deterioration trend in both boys and girls of all ages.
6. Endurance measured by endurance run and jumping ability by running long jump also showed a certain significant deterioration trend.
7. Physique is improving slowly year by year but most elements of physical fitness and motor ability are lowering, so the characteristics of physical fitness and motor ability are that physical fitness and motor ability are relatively inferior to physique.
8. Agility and explosive strength showed a certain stationary trend in the boys of all ages, so these two domains were rather superior to other domains of physical fitness and motor

ability.

9. In male and female aged over 30, physique domains showed a certain significant improving trend, except the body bulk of female aged 30 and 35.
10. Agility and explosive strength showed a distinct improving trend or stationary one and any significant deterioration trend was not found in these two domains for both male and female of all ages.
11. Endurance showed a certain distinct deterioration trend in the male and female of most ages.
12. For physical fitness as a whole, stationary trend was found in the male and female of all ages, except the male aged 40 who showed a significant improving trend and the female aged 30 who showed a significant deterioration trend.
13. It is another significant point that muscular strength showed a significant deterioration trend in only female of all ages.
14. The characteristics of male's physical fitness is that most of physical fitness domains but endurance are balanced with physique but endurance is much inferior to other domains and physical fitness as a whole is relatively equivalent to the physique.
15. The characteristics of female's physical fitness is that body bulk is unfavorably imbalanced with body linearity and muscular strength is inferior to other domains of physical fitness and physical fitness as a

whole is relatively a little inferior to body linearity but superior to body bulk.

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