中国諸民族の体力特性からの分類

松　浦　義　行・季　　　成　葉

Classification of tribes in China with reference to physical fitness characteristics

Yoshiyuki MATSUURA and Cheng-ye JI*

　1985年に中国では，3都市，25省に住む漢族及び27小数民族青少年（7歳から22歳）の約50万にのぼる標本に対し，測定法の訓練を施された検者によって，6形態項目，8体力項目の測定が実施された。この結果は「中国学徒の体力と健康に関する研究」と題して1988年に報告された。本研究はこの報告に含まれている3都市，25省の漢族及び27小数民族を6形態項目と血圧と心拍数を除いた6体力項目の民族別，性別，年齢別，項目別の統計値（平均値，標準偏差）を用いて体力特性の観点から分類し，分類された各群の体力特性をプロフィールとして表し，現代中国青少年の体力特性を考察した。

　民族間相関係数を性別，年齢別，項目別に各民族の平均値を標準化し，その標準化された平均値を各民族毎に性別，項目別に年齢をプールした平均値を求め，得られた12次のベクトルで各少数民族及び地域別漢族を表し，このベクトル要素を資料として民族間の相関係数をピアソンの方法で決定した。この相関行列に因子分析を施し，各民族の体力特性の共通性から分類を試みた。

　男子では7因子，女子では9因子が抽出され，1つの因子に対する負荷量の符号を考慮して，男子で11群，女子では15群に分類された。漢族の男子は4群，女子は5群に主に分類され，これらの群に属すると判断された小数民族は男子で4，女子で2と少なく，漢族と小数民族とは体力の観点から異なる特性を示すものと推測された。漢族が分類された各群は小数民族が分類された諸群に比べ，概して体力が優れており，特に形態が大であり，体力は形態とバランスを保持しているか，やや形態のわりに劣っているという特性を示していた。これに対し，小数民族が分類された群は概して体力全体としては漢族が分類された群より劣っていた。しかし，群内で体力要素の相互を比較すれば，形態の割には体力が優れている群が多いと推測された。小数民族の内，男子ではチュワン，朝鮮，リーの3族が，女子では朝鮮，ウインの2族が体力が優れていると推測された漢族と類似した体力特性を示していた。また，男女ともに漢族の内，青海省に住む漢族のみは体力の最も劣る小数民族と類似した体力特性を示していた。

Key words :　Classification, Physical Fitness, Chinese tribes, Factor analysis

1. Introduction

Only a few studies have been reported on the physical fitness of Chinese children and youth. The survey of their physical fitness was carried out for the first time in 1985. This survey was worked out cooperatively by National Educa-tional Committee, National Committee for Physical Exercise and Physical Education, Department of Hygiene and National Commit-tee for Tribes. The sample size was about 500, 000, including Han-tribe living in 3 cities ; Beijing, Tianjin and Shanghai, 25 provinces, and 27 minority tribes. The ages of subjects ranged from 7 to 22 years old. The sample size for each sex, each age and each area or minor-

＊ Institute of Child and Adolescent Health, Beijing Medical University

ity tribe was tried to be more than 100, although this could not always be satisfied. Three years were required for data processing, so the report titled "Research on Physical Fitness and Health of Chinese Students " was published in December 1988, although it involved the results by only simple processing of data. This report included sample size, mean, and standard deviation in each age, each sex, each city, each province and each minority tribe for 6 anthropometric measures and 8 physical fitness measures.

For measurement, the selected testers were given some intensive training for measurement and same kinds of measuring instruments were used. Therefore, the high reliability of measurement can be expected, so this report is very reliable and valuable for us to understand the present status of physical fitness of Chinese children and youth.

Then, this study was designed to classify the Han-tribe living in various areas and minority tribes according to physical fitness characteristics, and to investigate what the classified groups are characterized with physical fitness elements measured.

2. Methods and Procedures

1) Sample and measures

From Han-tribe living in three cities ; Beijing, Tianjin and Shanghai, 200 to 306 subjects were extracted, and 105 to 306 subjects were extracted from the urban area of 21 provinces and 4 self-governing districts, which are shown in Table 1, in each sex and each age, respectively. The same sizes of sample were also extracted from those who are living in the rural area of these cities, provinces and self-governing districts. Among 27 minority tribes, 100 to 200 subjects were extracted from the people living in the urban and rural areas separately in 5 tribes whose population were relatively large in both urban and rural ; Menggu, Hui, Weiwuer, Zhuan and Chaoxion-tribes. Then, from other 22 tribes, about 100 subjects were tried to

extract in each sex and each age without separation of urban and rural. With only a few exception, such as only 9 subjects were extracted for Sala-tribe boys aged 18, the sampling was done very satisfactorily. Such exception, however, was only 26.6% of total sample units in boys and 32.6% in girls. Total number of sample units was 12 (age) × 55 (cities, provinces and minority tribes) = 660 for boys and 12 × 53 = 636 for girls. Table 1 shows the cities, provinces and minority tribes involved in this study.

The measures given to the subjects were stature, sitting height, body weight, chest girth, shoulder breadth, hip breadth, vital capacity, 50 m dash, standing long jump, pull-ups ; modified pull-ups for boys aged 7 to 12 and pull-ups for those aged above 12 and sit-ups for 1 miniute for girls aged 7 to 22, trunk flexion, endurance run ; endurance shuttle run (50m × 8 times shuttle) for boys and girls aged 7 to 12, and 1000m run for boys aged above 12 and 800 m for girls aged above 12. Furthermore, pulse rate and blood presssure were also measured, but these two were not involved in processing for this study.

In this study, the data of boys and girls aged 7 to 18 were processed, because there were relatively large number of sample units whose sample sizes were smaller than 100 in ages of above 19 and the statistics were reported with age of 19 and above pooled.

2) Computational procedures

The mean and standard deviation were determined for each age, each sex and each measure with means of all sample units reported in "Research on Physical Fitness and Health of Chinese Students". The mean of each sample unit was standardized with the mean and the standard deviation determined previously for each age, each sex and each measure, respectively. Then, the mean of standardized means was computed with 12 ages pooled to determine the physical fitness vectors representing 3 cities and 25 provinces of Han-tribe, and 27 minority

Table 1   List of cities, provinces and minority tribes surveyed

Cities and Provinces; Han-tribe	Minority tribes
1 . Beijing-city	29. Mengguzu
2 . Tianjin-city	30. Huizu
3 . Heibeisheng	31. Weiwuerzu
4 . Shanxisheng	32. Zhuangzu
5 . Neimenggu*¹	33. Chaoxionzu
6 . Liaoningsheng	34. Znagzu
7 . Jilinsheng	35. Miaozu
8 . Heilongjiangsheng	36. Yizu
9 . Shandongsheng	37. Buyizu
10. Shanxisheng	38. Dongzu
11. Gansusheng	39. Yaozu
12. Qinghaisheng	40. Baizu
13. Ningxia*¹	41. Tujiazu
14. Xinjian*¹	42. Hanizu
15. Shanghai-city	43. Hasakezu
16. Jiangsusheng	44. Daizu
17. Zhejiangsheng	45. Lizu
18. Anhuisheng	46. Lisuzu
19. Fujiangsheng	47. Wazu
20. Jiangxisheng	48. Shezu
21. Henamsheng	49. Lahuzu
22. Hubeisheng	50. Dongxiangzu
23. Hunamsheng	51. Naxizu
24. Guangdongsheng	52. Keerezizu
25. Guangxi*¹	53. Tuzu
26. Sichuansheng	54. Qianzu
27. Guizhousheng	55. Salazu
28. Yunnamsheng	
Hanzu (Han-tribe) ; 3 cities, 21 provinces, and 4 self-governing areas	27 minority tribes

Note ; *1 denotes the self-governing area.

tribes.

Let the physical fitness vector representing k-th and l-th tribes be $(x_{k1}, x_{k2}, x_{k3}, \ldots x_{k12})$ and $(x_{l1}, x_{l2}, x_{l3}, \ldots x_{l12})$. The correlation between k-th and l-th tribes was determined on such way that Pearson's correlation is determined with these two physical fitness vectors.

$$r_{kl} = \frac{1/12 \sum_{i=1}^{12} (x_{ki} - x_k)(x_{li} - x_l)}{S_k \, S_l}$$

$$x_k = 1/12 \sum_{i=1}^{12} x_{ki} \quad x_l = 1/12 \sum_{i=1}^{12} x_{li}$$

$$S_k = 1/12 \sum_{i=1}^{12} (x_{ki} - x_k)^2 \quad S_l = 1/12 \sum_{i=1}^{12} (x_{li} - x_l)^2$$

Principal component solution was applied to the correlation matrix and the factor pattern matrix was rotated orthogonally with Normal Varimax criterion procedure. Then, classification was resulted by investigating factor loadings on the following two steps ; 1), to find out on which factor a given tribe loaded highest and 2), to divide the tribes which showed the highest loading on a factor into two groups with sign of loading. The physical fitness profile was evaluated with the following eight profile

domains determined a priori for each group.

The physical fitness profile domains are ;

(1) Body linearity ; Stature and sitting height,

(2) Body weight ; Body weight ;

(3) Body bulk ; Chest girth, shoulder breadth and hip breadth,

(4) Respiratory function ; Vital capacity,

(5) Fundamental motor ability ; 50m dash and standing long jump,

(6) Muscular endurance ; pull-ups or sit-ups,

(7) Flexibility ; Trunk flexion, and

(8) Endurance ; Endurance run.

These profile domain scores were given by standard score of measure involved in domain or mean standard score of measures involved in the domain when more than one measures are involved in one physical fitness domain, such as body linearity, body bulk, and fundamental motor ability domains.

3. Results

(1) Intercorrelation between cities and provinces of Han-tribe and minority tribes.

The correlation matrix between them was (55 x 55) for boys and (53 x 53) for girls, because Zhuang-tribe and Keerezi-tribe were excluded for processing in girls because of funny mean data involved. Such a big correlation matrix can not be shown, so the significant correlations of Beijing with others were shown as an example in Table 2. In both boys and girls, Beijing showed significant and high positive correlation with considerable number of cities and provinces of Han-tribe, but significant and high negative correlations with several minority tribes.

In boys, three big cities ; Beijing, Tianjin and Shanghai, correlated each other significantly, so it could be anticipated that Han-tribe living in these three big cities are very similar in physical fintess.

In girls, however, significant correlation was not found between Beijing and Shanghai, so it

could be inferred that Han-tribe girls are similar in physical fitness between Beijing and Tianjin but Shanghai Han-tribe girls are different in physical fitness from Beijing and Tianjin. Table 3 shows the boy's physical fitness profile scores of these three cities and Dong-tribe which showed significant and high negative correlation with Beijing. It can be easily understood that three cities seemed to be very similar each other in physical fitness profile but Dong-tribe showed just reverse profile from three cities.

Table 4 shows the girl's physical fitness profile scores of them. As shown in Table 2, significant similarity in physical fitess was found between Beijing and Tianjin but Shanghai was found different from them, although some similarity was found in physique domains, and Dong-tribe showed just reverse profile from that of Beijing.

There were found 9 minority tribes for boys and 10 for girls which showed significant and negative correlation with Beijing. It could be anticipated that these minority tribes might show the same type of physical fitness profile as that of Dong-tribe. As shown in profile of Dong-tribe in table 3 and 4, They could be considered to be inferior in every domain of physical fitness to Beijing. However, the degree of inferiority was larger in physique domain than in motor ability domains.

From comparison in physical fitness profile, it could be evidenced that the correlation matrix might show the similarity in physical fitness between cities and provinces of Han-tribe and minority tribes.

Between Beijing and Tianjin, a certain high similarity was found in boys as shown in correlation and profile as well. In girls, however, significant similarity was found but not so high as in boys. Thus, from this, it may be suggested that girls are more susceptible ; in other words, more adaptable, to the environmental influences than boys. This was evidenced by several past studies, such as Ohyama (1968), Malina

Table 2 Cities, provinces and minority tribes showing high correlation with Beijing city in terms of physical fitness

Sex / Province and Tribes[1]	Boy +	Boy −	Girl +	Girl −
2 . Tianjin-city	.924		.807	
3 . Heibeisheng[2]	.802		.875	
5 . Neimenggu[3]	.729		.828	
6 . Liaoningsheng	.660		.746	
7 . Jilinsheng			.637	
8 . Heilongjinangsheng	.794		.655	
9 . Shandongsheng	.899		.888	
10. Shanxisheng	.654			
11. Gansusheng	.863		.825	
15. Shanghai-city	.842			
16. Jiangsusheng	.842		.742	
17. Zhejiangsheng	.688			
19. Fujiangsheng	.690			
21. Henamsheng			.734	
22. Hubeisheng	.644		.612	
24. Guangdongsheng			.698	
34. Zangzu[4]		−.646		−.790
35. Miaozu		−.782		−.857
37. Buyizu		−.881		−.677
38. Dongzu		−.903		−.892
39. Yaozu		−.806		
44. Daizu		−.762		
47. Wazu		−.668		
48. Shezu				−.710
49. Lahuzu		−.886		−.914
50. Dongxiangzu				−.734
52. Keerkezizu				−.816
53. Tuzu				−.731
55. Salazu		−.660		−.827

Note ; * 1 Province and tribes means Cities, Provinces and Minority tribes.
The subjects who are classified as city and province are all Han-tribe.
* 2 Sheng means province.
* 3 Neimengguzizhiqu denotes Neimenggu self-governing province.
* 4 Zu means tribe.

and Mueller (1981), Park and Matsuura (1990) and others. Particularly, Ohyama's and Park's studies showed the degree of contribution of environmental conditions to physical growth and development with correlation and reported that correlations were higher in girls than boys.

(2) Classification of Han-tribe and minority tribes by factor analysis and physical fit-

ness characteristics of each group classified.

Complete principal component analysis was used to factor the inter-tribe correlation matrix and the components whose eigen values were positive were extracted. The extracted components were rotated orthogonally with Normal Varimax criterion procedure to produce the

Table 3 Physical fitness profile score for three cities and one minority tribe for an evidence of intercorrelation with Beijing-city in terms of physical fitness ; Boys

Physical fitness domain	Bejijng	Tianjin	Shanghai	Dongzu
1 . Body linearity	1.78	1.38	1.45	−1.68
2 . Body weight	2.19	1.63	1.61	−1.38
3 . Body bulk	1.52	1.17	1.26	−1.26
4 . Respiratory func.*¹	1.56	1.39	1.21	−1.40
5 . Fundamental M. A. *²	.87	.56	.32	−1.19
6 . Muscular endurance	−.35	−.86	−625	−.60
7 . Flexibility	.11	.48	−.98	−.30
8 . Endurance	.72	.12	−.50	−.25
Correlation with Beijing	1.000	.924	.842	−.903

Note ; 1) * 1 denotes respiratory function measured by vital capacity and * 2 stands for fundamental motor ability.

2) Physical fitness profile scores are given by standard score.

Table 4 Physical fitness profile score for three cities and one minority tribe for an evidence of intercorrelation with Beijing-city in terms of physical fitness ; Girls

Physical fitness domain	Bejijng	Tianjin	Shanghai	Dongzu
1 . Body linearity	1.69	1.32	1.29	−1.85
2 . Body weight	1.89	1.53	1.16	−1.39
3 . Body bulk	1.16	.99	.92	−.97
4 . Respiratory func.*¹	.94	.84	1.16	−1.52
5 . Fundamental M. A. *²	.99	.55	−.11	−.76
6 . Muscular endurance	1.14	.13	1.25	−1.39
7 . Flexibility	.31	.50	−.58	.04
8 . Endurance	.64	−.35	−.68	−.11
Correlation with Beijing	1.000	.807	.596	−.892

Note ; 1) * 1 denotes respiratory function measured by vital capacity and * 2 stands for fundamental motor ability.

2) Physical fitness profile scores are given by standard score.

factor pattern matrix for each sex, respectively. In both sexes, most of the reproduced communalities ; more than 94% in boys and 100% in girls, were greater than. 9, so it could be inferred that the intertribe correlation matrix was factored very satisfactorily.

Seven factors were extracted in boys and 9 in girls, so it could be anticipated that Han-tribe living in 3 big cities and 25 provinces and 27 minority tribes could be classified into 14 groups in boys and 18 in girls, because the tribe showing positive loading on one factor must be judged to be different in physical fitness from the ones showing negative loading on the same factor. What group a given tribe belongs to was determined by investigating which factor it loaded highest on in the extracted factors and also the sign of the highest loading.

Table 5 shows the resulted classification of 3 big cities and 25 provinces of Han-tribe and 27 minority tribes in boys. The group 1 consisted of 12 provinces of Han-tribe and three minority tribes, and their factor loadings on factor 1 were positive. The group 2 consisted of one province of Han-tribe ; Qinghai-province, and 10 minority tribes and their factor loadings on

Table 5　Classification of cities, provinces and minority tribes due to physical fitness ; Boys

Factor	Sign[2]	Groups	No	No. of citiy, province and tribe[1]
1	+	1	15	3, 6, 7, 14, 16, 21, 22, 23, 24, 25, 26, 28, 32, 33, 45
	−	2	11	12, 30, 34, 35, 37, 38, 39, 48, 50, 53, 55
2	+	3	7	4, 5, 11, 13, 15, 17, 19
	−	4	5	31, 41, 46, 47, 54
3	+	5	2	8, 20
	−	6	2	42, 52
4	+	7	6	1, 2, 9, 10, 18, 43
	−	8	2	44, 49
5	+	9	1	36
	−	10	3	29, 40, 51
7	+	11	1	27
Total		11	55	

Note :　1)　＊1 : No. of city, province and tribe corresponds to No. descibed in Table 1.
　　　　2)　＊2 : Sign dentoes the sign of factor loading, so + in i-th factor means the tribes which loaded most on the i-th factor and its loading was positive.

factor 1 were negative, so the physical fitness characteristics of group 1 was considered just reverse to that of group 2. The group 3 consisted of one big city ; Shanghai, and 6 provinces of Han-tribe, and the group 4 of 5 minority tribes. Then, as interpreted in the group 1 and 2, the physical fitness characteristics of group 3 was considered reverse to that of group 4. The group 5 consisted of two provinces of Han-tribes and the group 6 of 2 minority tribes. The group 7 consisted of 2 big cities ; Beijing and Tianjin, 3 provinces of Han-tribe and one minority tribe ; Hasake-tribe, and the group 8 of 2 minority tribes. Then, the group 9 consisted of only one minority tribe ; Yi-tribe, and the group 10 of 3 minority tribes. Lastly the group 11 consisted of one province of Han-tribe ; Guizhuan-province.

Most of Han-tribe belonged to the groups 1, 3,5 and 7, with only 2 exceptions ; Gansu- and Qinghai- provinces, and the minority tribes belonging to these groups were Zhuang, Chaoxion, Li-tribes in the group 1, Hasake-tribe in the group 7, so these minority tribes were estimated as similar in physical fitness to Han-

tribe. Contrary, most of minority tribes belonged to the groups 2,4,6,8,9 and 10. These groups were characterized by the fact that their factor loadings were negative. Therefore, according to the classification procedure mentioned previously, 3 big cities and 25 provinces of Han-tribe and 27 minority tribes were classified into 11 groups.

Table 6 shows the physical fitness profile score of each group. The physical fitness characteristics of group 1 is, as shown in Table 6, that motor ability domain is relatively a little superior to physique and profile is rather balanced, as pfofile balance score shows ; .202. But mean profile score was .589, which ranks the second in magnitude. Thus, it could be inferred that the group 1 showed such physical fitness characteristics that all physical fitness elements were relatively superior and balanced each other.

The group 3 showed such characteristics that physique domains are much superior to muscular endurance, flexibility and endurance and then physical fitness profile was rather imbalanced, because the balance score was .467,

Table 6   Physical fitness profile scores of each group ; Boys

G #	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	Mean	BS	R
1	.561	.447	.366	.326	.917	.852	.557	.688	.589	.202	2
2	−.916	−1.037	−.725	−.947	−1.249	−.982	−.937	−1.016	−.981	.136	11
3	.813	.644	.427	.451	.381	−.122	−.668	−.210	.215	.467	4
4	−.908	−.515	−.334	−.529	−.500	−.046	1.117	.364	−.169	.601	6
5	.793	.643	.537	.208	.305	−.053	.157	−.182	.301	.317	3
6	−1.034	−.690	−.483	.747	−.714	.378	−.104	.061	−.230	.568	8
7	.989	1.254	.975	1.077	.435	−.356	.482	.253	.639	.501	1
8	−1.757	−1.644	−1.602	−1.402	−.932	.887	−.263	−.527	−.905	.849	10
9	−.890	−.574	−.474	.275	−.612	.091	.460	−.064	−.224	.450	7
10	−.118	−.113	−.179	−.136	.175	−.186	−.576	.213	−.103	.229	5
11	−.181	−.460	−.580	−.726	−.025	−.716	.134	−.286	−.343	.320	9

Note ;
1) G # stands for group ID #, which is shown in Table 5.
2) P_1, i=1, 2, ... 8 denotes physical fitness profile domains, which are shown in Table 4.
3) Mean is the average of eight physical fintess profile scores.
4) BS denotes balance score of physical fitness profile, which is determined by standard deviation of profile scores.
5) R denotes the rank order due to mean of physical fitness scores.

which is larger than that of group 1. The mean profile score was .215, but the profile score was negative in muscular endurance, flexibility and endurance.

The group 5 showed such characteristics of physical fitness that motor ability domains are relatively inferior to physique domains but their inferiority was not so much as that of group 3, because the profile balance score was .317, which was a little less than that of group 3.

The group 7 was characterized by the profile that physique domains are most superior to other groups but motor ability domains are much inferior to physique domains and particularly, muscular endurance was serious in degree of inferiority, compared with profile scores of other domains. Table 6 shows the profile scores, mean scores and balance score and rank order due to magnitude of mean profile score. To the group 7, which showed the largest mean profile score, the group 1,5 and 3 which showed the positive mean profile score, most of Han-tribe belonged. Contrary, most minority tribes belonged to the group whose mean profile scores were negative. Therefore, it could be concluded that Han-tribe boys are superior in overall physical fitness to minority tribes, no matter wherever they live.

The group 2 showed the smallest mean profile score, so it could be inferred that the group 2 might be most inferior in physical fitness. As shown in Table 2, the profile of group 2 seemed to be rather balanced but all profile scores were negative and three of them less than −1.0.

The group 4 consisted of 5 minority tribes shows such physical fitness characteristics that muscular endurance, flexibility and endurance are much superior to physique domains. This is just reverse to the group 3.

The group 6 consisted of only two minority tribes shows such characteristics that respiratory function and muscular endurance domains are superior to other domains but physique domains are inferior for motor ability domains. Its profile seemed to be reverse to that of group 5.

The group 8 showed such characteristics that motor ability domains are much superior to physique domains which are most inferior to other groups and particularly muscular endurance is most superior to other groups. Thus, it could be concluded that the group 8 ; Dai and

Lahu tribes, is strong at muscular endurance for their physique, even though their physique was most inferior in all groups and the chracteristics of group 8 was just reverse to that of group 7, which was considered most superior in physical fitness as a whole and Beijing and Tianjin belonged to.

In the group 9, motor ability domains were a little superior to physique domains, and the group 10 was relatively balanced among 7 physical fitness domains except flexibility, as balance score shows ; 229. The group 11 was relatively balanced among these eight profile domains except that respiratory function and fundamental motor ability tended to be a little inferior to other domains. The groups 9,10, and 11 showed relatively balanced physical fitness profile, but their absolute values of mean profile scores were very small, so it could be inferred that these three groups were likely to be average in physical fitness.

Thus, it could be inferred that Han-tribe was classified into four groups and their physical fitness charactreristics were superior in general to those of minority tribes and particularly, their physique was significantly larger than those of minority tribes, although only a few minority tribes were classified to these four groups. Seven groups other than these four mentioned previously consisted mainly of only minority tribes.

For girls, 9 factors were extracted and 15 groups were identified, as shown in Table 7.

The group 1 consisted of 2 big cities and 13 provinces of Han-tribre, and one minority tribe ; Chaoxion. Its physical fitness profile was very balanced, because the balance score was .172, and it was smallest in all groups. The mean profile score was largest, so the group 1 was most superior in physical fitness as a whole. This can be easily understood by Table 8.

Table 7　Classification of cities, provinces and minority tribes due to physical fitness ; Girls

Factor	Sign*2	Groups	No	No. of citiy, province and tribe*1
1	+	1	16	1, 2, 3, 5, 6, 7, 9, 11, 14, 16, 18, 21, 23, 24, 25, 33
	−	2	10	12, 34, 35, 37, 38, 48, 49, 50, 53, 55
2	+	3	8	4, 13, 15, 17, 19, 20, 22, 30
	−	4	4	41, 46, 47, 54
3	+	5	2	29, 40
4	+	6	1	27
	−	7	1	45
5	−	8	1	51
6	+	9	2	8, 10
	−	10	3	26, 36, 42
7	+	11	1	43
	−	12	1	44
8	−	13	1	39
9	+	14	1	31
	−	15	1	28
Total		15	53	

Note : 1)　*1 : No. of city, province and tribe corresponds to No. described in Table 1.

2)　*2 : Sign denotes the sign of factor loading, so + in i-th factor means the tribes which loaded most on the i-th factor and its loading was positive.

Table 8　Physical fitness profile scores of each group ; Girls

G #	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	Mean	BS	R
1	.901	.755	.575	.667	.756	.896	.570	.354	.684	.172	1
2	−1.049	−.968	−.576	−.809	−1.133	−.947	−.295	−.838	−.827	.256	14
3	.688	.389	.037	.328	.039	.479	−.745	−.255	.120	.429	5
4	−.997	−.107	−.090	−.481	.013	−.794	1.390	.489	−.072	.708	8
5	−.427	−.206	−.164	−.514	.295	.173	−.394	.559	−.085	.361	9
6	−.121	−.421	−.424	.339	−.178	.109	−.015	−.386	−.137	.257	10
7	−.166	−.365	.433	−1.304	1.299	−.328	−.365	1.210	.052	.823	6
8	.176	−.304	.605	−.384	.024	−.116	−1.008	−.101	−.138	.436	11
9	.799	.564	.643	.303	.092	.736	.243	−.301	.385	.349	2
10	−.582	−.356	−.652	.628	.146	−.820	−.297	.271	−.208	.474	12
11	−.020	1.458	.677	.855	−.652	−1.760	−.197	−.107	.032	.927	7
12	−1.134	−1.375	−1.154	−1.606	.544	−.891	.263	.169	−.648	.784	13
13	−1.561	−1.423	−.613	−1.503	−.833	−.165	−.717	2.775	−.852	.562	15
14	−.255	.082	−.425	−.528	−.779	−.453	1.149	−.423	−.204	.560	4
15	.268	.000	.491	1.018	.555	.755	−.210	−.315	.320	.440	3

Note ;　1)　G # stands for group ID #, which is shown in Table 5.

2)　P_i, i = 1, 2, ... 8 denotes physical fitness profile domains, which are shown in Table 4.

3)　Mean is the average of eight physical fintess profile scores.

4)　BS denotes balance score of physical fitness profile, which is determined by standard deviation of profile scores.

5)　R denotes the rank order due to mean of physical fitness scores.

The group 3 consisted of 7 provinces of Han -tribe and one minority tribe ; Hui-tribe. This group showed such physical fitness characteristics that flexibility and endurance were inferior to other physical fitness domains and the profile seemed to be a little imbalanced, as balance score showed ; .429.

The group 6 consisted of only one province of Han-tribe ; Guizhou. Its physical fitness profile was considered rather balanced, because the balance score was .257, but mean profile score was -.137. Thus, Han-tribe living in Guizhou province was considered to be strong at respiratory function but weak at flexibility compared with other physical fitness domains and a little inferior in overall physical fitness.

The group 9 consisted of 2 provinces of Han -tribe ; Heilongjiang and Shanxi, and, as shown in Table 8, its profile shows that physique domains are rather balanced and superior to other motor ability domains except muscular endurance which showed similar profile score as those of physique domains, but endurance is very inferior for their physique. The mean profile score was .385, which ranked the second in magnitude. Thus, it could be concluded that this group was rather superior in physical fitness as a whole.

The group 15 consisted of only one province of Han-tribe ; Yunnam. The mean profile score was .320, which ranked the third in magnitude. Particularly, the profile score of respiratory function was 1. 018, which was largest in all groups and larger than those of other domains, but flexibility and endurance were infreior to other domains.

Han-tribe was classified to these five groups with two exceptions ; Qinghai and Sichuan provinces. These groups showed the positive mean profile score except the group 6, so it could be inferred that most of Han-tribe girls are relatively superior in physical fitness as a whole, although each group showed some different characteristics from each other. Among 27

minority tribes, only Chaoxion belonged to the group 1, so Chaoxion tribe girls are as superior in physical fitness as Han-tribe girls who showed the most superior physical fitness.

The group 2 consisted of one province of Han-tribe and 9 minority tribes, which loaded negatively on factor 1, so its characteristics of physical fitness profile was anticipated as reverse to that of the group 1. This can be understood easily by physical fitness profile presented in Table 8. The mean profile score was -.827 and balance score .256, so this group was characterized by profile whose scores were low as a whole and rather balanced.

The group 4 consisted of 4 minority tribes. Its characteristics of physical fitness was that flexibility was very superior and endurance was a little superior to other domains but other domains were rather inferior. The mean profile score was -.072 but balance score .708, so profile was considered to be rather imbalanced. It could be concluded that this group can be characterized as average in overall physical fitness but very much imbalanced among different physical fitness domains.

The group 5 consisted of only three minority tribes ; Menggu, Zhuang and Bai tribes, and the mean profile score was -.085, which was not so different from that of group 4 but the balance score was .361. Thus, this group was considered to be almost equivalent in physical fitness to the group 4 but more balanced than the group 4.

The group 7 consisted of only one minority tribe ; Li-tribe. Its physical fitness profile was very imbalanced, as shown in Table 8, and physical fitness was characterized by that fundamental motor ability and endurance were very superior but respiratory function, muscular endurance and flexibility were very inferior. The mean profile score was .052 but balance score .823, so it could be inferred that this group was average in overall physical fitness but imbalanced in its profile.

The group 8 consisted of only one minority tribe ; Naxi-tribe. Its physical fitness was char-

acterized by that flexibility and respiratory function are weak but body bulk is relatively large. The mean profile score was -.138 and balance score .436, so the profile was considered as not so balanced but physical fitness was a little low as a whole.

The group 10 consisted of one province of Han-tribe ; Sichuan, and two miniority tribes ; Yi-and Hani-tribes. Its physical fitness was characterized by such trait that three physique domains are very inferior and muscular endurance is a little inferior but fundamental motor ability and endurance are very superior. The mean profile score was -.208 and balance score .474, so it could be inferred that this group is inferior in physical fitness as a whole and a little imbalanced.

Furthermore, each of Hasake, Dizu, Yao, and Weiwuer-tribes constructed one group ; group 11,12,13 and 14, respectively. Their characteristics of physical fitness are shown by physical fitness profile scores in Table 8. Particularly, the group 13 was characterized by such trait that physique domains are very inferior but endurance is very strong but the mean profile score was -.852, which meant that physical fitness was most inferior in all groups.

4. Discussion

For classification of individual in reference with physical fitness, the similarity or dissimilarity between individuals must be evaluated. In general, dissimilarity is evaluated by some kind of distance between them and similarity by correlation. If the inter-distance matrix is given, cluster analysis procedure can successfully be applied for classification, and if inter-correlation matrix is given, cluster analysis or factor analysis procedure can be applied.

In this study, the factor analytic procedure was used. This procedure is trying to find out a group of individuals which are constructed in a considerable amount by common quality of some kind. This study is to attempt to classify the tribes into several groups in reference with

physical fitness, so correlation matrix was constructed with physical fitness measures utilized. This is the same idea as the inter-personal correlation used in Q-technique of factor analysis.

Matsuura (1973,1977) proposed a certain useful procedure to compute the inter-personal or inter-group correlation and attempted to classify several sports teams of college boys and girls in reference with physical fitness variables. He stated that the intercorrelation between groups should be computed with the vector whose elements are orthogonal, and he proposed the procedure to transform the primary vector whose elements are not orthogonal to another vector whose elements are orthogonal. Then, he stated that the inter-personal or group correlation should be calculated with the elements of this transformed vector. This transformation, however, was not worked out in this study, because the physical fitness characteristics of each group classified were intended to be investigated with the eight ability domains hypothesized a priori ; body linearity, body weight, body bulk, respiratory function, fundamental motor ability, muscular endurance, flexibility and endurance.

Research Section of Constitution and Health of Chinese Students (1988) reported that most of Han-tribes were generally superior in physical fitness to minority tribes and minority tribs living in southern areas were superior in physical fitness to those living in northern areas in China. In this study, however, a few minority tribes, such as Chao-Xian and Hui, who are mainly living in northern areas and Zhuong mainly in southern areas showed better status of physical fitness than others. Particularly, Chao-Xian tribe was classified into same group of physical fitness as Beijing and Tianjin classified in girls, and they were classified into the group which Han-tribes living in many provinces belonged into in boys. In boys, Zhuang and Li, who inhabit mainly in southern and central areas, also showed same characteristics as

many Han-tribes did. Furthermore, Hasake inhabitting mainly in northern area was classified into the same group which Beijing and Tianjin were classified into in boys. On the other hand, Han-tribe living in Qinghai province ; northern area, was classified into the same group into which many minority tirbes were classified in both boys and girls. The mean profile score of this group was -.512 and -.488 for boys and girls, respectively, so it could be inferred that they were most inferior in physical fitness among Han-tribes living in various areas.

Han-tribe was mainly classified into 4 groups with a few minority tribes together in boys and 5 groups in girls, and they showed the better status of physical fitness among the groups classified. In girls, however, three groups of 5 ; group 1 to which Beijing and Tianjin belonged, group 9 to which Heilongjian and Shanxi belonged, and group 5 to which only Yunnam belonged showed superior status of physical fitness among five groups mainly consisted of Han-tribes.

On the other hand, minority tribes were classified into 6 groups in boys and 10 groups in girls with Han-tribes living in a few areas together. They showed relatively inferior status of physical fitness in both sexes. This was well in accordance with the report by the research report edited by Research Section of Constitution and Health of Chinese Students (1988). Even if it could be assumed that Han-tribes living in various areas may have same origin genetically, they were different in physical fitness characteristics according to the areas they live in. However, Han-tribes living in 28 different provinces were classified into 4 or 5 groups in boys and girls. Taking the difficulty of mobility from one area to another into consideration, a certain common characteristics genetically determined may be still relevant for physical fitness of Chinese youth. This is verified by such fact that minority tribes were classified into more number of groups showing

different physical fitness characteristics in both sexes.

5. Conclusion

Factor analytic procedure was used to classify Han-tribe living in 3 big cities and 25 provinces and 27 minority tribes in reference with physical fitness measured by six physique items and six motor ability items. Then, seven factors were extracted in boys and nine in girls. The tribes who loaded significantly and highly on one factor were classified into two groups according to the sign of loading. After all, 11 groups were identified in boys and 15 in girls. Then, the followings were concluded.

1) Han-tribes living in most of three big cities and provinces could be classified into the groups different in physical fitness from the group into which most of minority tribes were classified in both sexes.

2) The groups which Han-tribes were classified into were superior in physical fitness as a whole to the groups which most of minority tribes were classified into.

3) The group which Beijing and Tianjin were classified into showed the most superior status of physical fitness in both sexes, while the groups which Hui, Znag, Miao, Buyi, Dong, Yao, Dai, Li, She, Lahu, Dongxian, Tu and Sala were classified into showed the most inferior status of physical fitness in both sexes.

4) Among Han-tribes living in 3 big cities and 25 provinces, only Han-tribe living in Qinghai-province was classified into the group which the minority tribes mentioned in 3) were classified into.

5) The characteristics of the group which was considered most superior in physical fitness and Beijing and Tianjin were classified into was that physical fitness profile was considerably balanced and its profile scores were high compared with other groups in both sexes.

6) One of three big cities ; Shanghai, is different in physical fitness characteristics from other two ; Beijing and Tianjin. Its characteris-

tics of physical fitness was that motor ability domains were much inferior for physique domains.

7) In general, Han-tribes living in three big cities ; Beijing, Tianjin and Shanghai, showed that physique domains are superior to motor ability domains, but the inferiority of motor ability for physique was more serious in Shanghai than other two cities.

8) In general, minority tribes were inferior in physique domains to Han-tribes, and their motor ability domains were likely to be superior for their status of physique.

9) Among minority tribes, Chaoxion-tribe showed the characterisitics similar in physical fitness to that of Han-tribe which was rather superior in physical fitness as a whole. And Hasake-tribe boys also showed superior status of physical fitness, whose profile was similar to those of Beijing and Tianjin of Han-tribe, but Hasake-tribe girls showed the specific physical fitness profile different from others.

10) The tribes whose physical fitness profile was rather balanced and their scores were rather high were Han-tribes living in Heibei, Liaoning, Jilin, Xinjan, Jiangsu, Hunam, Guangdong, Guangxi, Sichuuan, Yunnam provinces and Zhuang, Chaoxion, Li tribes in boys, which were classified to group 1. In girls, such tribes were Han-tribes living in Beijing, Tianjin cities, and Heibei, Neimengg, Liaoning, Jilin, Shandong, Gansu, Xinjian, Jiangsu, Anhui, Henam, Heram, Hunam, Guangdong, Guangxi provinces, and Chaoxion-tribe, which belonged to the group 1, and these tribes showed the most superior status of overall physical fitness.

11) The tribes whose overall physical fitness was most superior were Han-tribes living in Beijing, Tianjin cities, and Shandong, Shanxi, Anhui provinces and Hasake-tribe in boys, which belonged to the group 7.

12) The tribes whose overall physical fitness was most inferior were Han-tribe living in Qinghai province and Hui, Znag, Miao, Buyi, Dong, Yao, She, Dongxian, Tu, Sala-tribes in

boys, which were classified into the group 2, and their physical fitness profile was rather imbalanced. In girls, such tribes were Yao-tribe which was classified into the group 13 and Znag, Miao, Buyi, Dong, She, Lahu, Dongxiang, Tu, and Sala-tribes which were classified into the group 2, and the physical fitness profile was rather imbalanced in Yao-tribe but that of others was rather balanced.

13) The rank order according to overall status of physical fitness was the group 7,1,5,3,10,4,9,6, 11,8 and 2 in boys. The mean physical fitness scores of the group 7,1,5, and 3 were positive but those of other groups were negative. In girls, such rank order was the group 1,9,15,14,3,7,11,4, 5,6,8,10,12,2 and 13, and the profile scores of the group 1,9,15,14,3 and 7 were positive but those of others were negative. In the groups whose absolute values of mean profile score are nearly zero, their profile balance scores were relatively large, so it could be inferred that physical fitness profile was relatively imbalanced in the groups showing average status of physical fitness.This trend was not identified in boys.

Bibliography

1) Eveleth PB and Tanner JM (1976) : Worldwide Variation in Human Growth, IBP 8, Cambridge Univ. Press, London, pp. 118-157, 222-261.

2) Ichimura S (1967) : An attempt to classify persons in reference with motor ability. Research J. of Physical Education 11 (4) : 237-243

3) Malina RM and Mueller WH (1981) : Genetic and environmental influence on the strength and motor performance of Philadelphia school children. Human Biology. 53 (2) : 163-179.

4) Matsuura Y (1973) : On the intergroup similarity and specificity : The study of intergroup similarity and correlation among several college sport teams. Research J of Physical Education 18 : 2, 91-101

5) Matsuura Y (1977) : Classification of college sport teams by fundamental motor ability. Jpn. J Phys Educ 22(4) : 189-201.

6) Ohyama Y (1968) : The factors contributing to the development of motor ability. Research . of Phys Educ 13-(1) : 58-65

7) Park TS and Matsuura Y (1990) : A Study on the major infulential items of living conditions affecting physical growth and development of school children. Jpn J of Phys Educ 34 (4) : 345-358

8) Research Section of the Constitution and Health of Chinese Students (1988) : Study of the current situation of the Han nationality students' body fitness, characteristics and regularities of the the development and change, in Researches on the Constitution and Health of the Chinese Students, ed. by State Education Commission, State Physical Culture Commission. Ministry of Public Health, and State Nationalities Affairs Commission, pp. 144-185.

9) Research Section of the Constitution and Health of Chinese Students (1988) : Analysis and study of body fitness of Chinese minority nationalities students, in Researches on the Constitution and Health of the Chinese Students, ed. by State Education Commission, State Physical Culture Commission, Ministry of Public Health, and State Nationalities Affairs Commission, pp. 325-343.

10) Stephenson W (1952) : Some observation on Q-technique. Psychological Bulletine 49 : 483-498.