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THE RELATION OF CERTAIN MEDICAL AND PHYSICAL DATA TO SCHOLASTIC SUCCESS

FREDERIC S. BEEBEE

This study was undertaken for the purpose of discovering any items in the records of the Department of Physical Education for Men (at the University of Iowa) which might be of significance in relation to scholastic attainment. The technique employed involved a comparison of the two extremes in scholastic standing among the freshman men of the College of Liberal Arts for the academic year 1925-26. The records of the 52 men receiving the highest grades and the 54 men receiving the lowest grades in the entire freshman class were considered.¹

Following the procedure determined upon, the HG and LG groups were compared in all the records of the Department of Physical Education for Men. The material thus obtained was examined for the purpose of discovering any data which might prove important in relation to scholastic success or failure in the classroom. The records considered were as follows:

- I Anthropometric Measurements.
- II Physical Efficiency Tests.
- III Medical Examination.
- IV Medical History.
- V Social History.
- VI Class Absences.
- VII Grades in Physical Education.

The data are in part incomplete, owing in general to a variety of causes such as: absence from class on the day of examination; excuse from the course; or withdrawal from the class before the end of the semester.

I. — ANTHROPOMETRIC MEASUREMENTS

The anthropometric measurements were taken during the first few weeks of the school year by the instructors in the department. The different measurements considered are as follows: age, weight, height, neck circumference, circumference of chest when contracted, chest expansion, circumference of the right upper arm midway between elbow and shoulder while the arm is extended, the

¹ For convenience, these groups will be referred to in this study as HG and LG respectively.

same measurement with the arm contracted to obtain bicep development, waist circumference, right thigh circumference, circumference of right calf, lung capacity, right grip, left grip, back lift, back and leg lift, dipping, and chinning. All measurements were taken in terms of inches, pounds, cubic centimeters, or number of successful trials.

Summary

1. The LG group was older than the HG.
2. The LG group was found to exceed the HG in measurements of size. The difference was at least 4 PE in the measurements of weight, neck circumference, chest circumference, circumference of right upper arm extended, circumference of waist, circumference of right leg, and the number of times of chinning. This observed difference indicates that by chance it would occur not more than once in 144 times.
3. The LG group was superior to the HG in measurements of height, size of biceps, circumference of right thigh, lung capacity, right grip, left grip, back lift, back and leg lift, and times of dipping. The differences between the two groups on these tests were not great enough to be statistically significant; however, there was a constant tendency for the LG to be superior in these tests of ability as well as those of size.
4. The HG group exceeded the LG in chest expansion, but the difference was not found to be statistically significant.²

II — PHYSICAL EFFICIENCY TESTS

The various physical efficiency tests were given at intervals during the semester, and, for the reasons previously stated, the data were found to be incomplete in a number of cases. The tests in the group included: fence vault, rope climb, running high jump, chinning, dipping, broad jump, forty-yard swim and posture. In each test the student was ranked on a scale ranging from 4 as high down to zero as low according to his performance.

Summary

1. The LG group was found to excel the HG to a significant degree only in the broad jump where the ratio of the observed difference of the means to the probable error of the means was 4.39.
2. The LG group was found to be slightly better than the HG in the fence vault, rope climb, high jump, dips, chins and posture. While the differences found were not great enough to be statistically significant, the consistency of manifold slight differences in favor of the LG indicates, but does not prove, that they are of probable significance. They may be due to the greater age of the LG group.
3. In the forty-yard swim the HG group excelled the LG. While

² Note. For detailed summary see Table I.

this difference is not great enough to be of statistical significance, the fact that the only test of physical efficiency in which the HG group excelled was possibly the one requiring the greatest amount of coördination may be important.³

III — MEDICAL EXAMINATION

Besides the anthropometric measurements and physical efficiency tests the records of the physician in the department were examined to discover any items of diagnostic importance in relation to scholastic success. These records included the physician's notes on each man's medical examination, and, in addition, a short medical and social history, his present complaints, and those social factors which might be of importance in relation to the physical well-being of the individual.

The physician's notes included records of each individual's vision, hearing, teeth, throat, heart, lungs, abdomen, postural and skeletal conditions. In addition, each man was ranked on a scale of five as to his general appearance.

General Appearance. — The difference between the two groups was not sufficiently great to be of significance, although the LG group was considered to be of slightly better appearance.

Vision. — The Snellen test card was used in examining the visions of 43 men in the HG group and 29 men in the LG. It was found that the men in the LG group had better vision than the members of the HG. Three-fourths of the LG group had normal vision while less than one-half of the HG group had vision that was considered normal. Two of those in the HG group that were classified as defective in vision had the defect corrected, while 3 of the 7 in the LG group wore glasses.

Hearing. — Two of the men in the HG group had slightly impaired hearing, while one of the LG group was handicapped in the same manner.

Teeth. — The examination of the teeth covered their condition, amount of dentistry present, and regularity. There was no difference between the two groups as to the condition of their teeth.

Throat. — Examination of the throat was made primarily to discover the condition of the tonsils. In this item a significant difference existed between the two groups. Of the HG group 55 per cent as compared with 25 per cent of the LG group had tonsils so diseased that they were advised to have them removed.

Lungs. — All the lungs examined in the two groups were found to be in normal condition.

³ Note. For more detailed summary see Table II.

Heart. — There was no significant difference in the heart conditions of the two groups.

Skeletal and Postural. — There was practically no difference between the two groups in the number of skeletal and postural defects found.

Extremities. — In the examination of the extremities the differences between the HG group and the LG were not marked. However, of the HG group, 81.5 per cent had no (or very slight) defects, as compared to 67.7 per cent of the LG group.

Summary

1. The LG group was found to be slightly superior in general appearance, to have better vision, and to be less handicapped by diseased tonsils than the HG.

2. The HG group had fewer extremity defects.

3. There were no significant differences between the two groups in hearing, teeth, lungs, heart, skeletal and postural conditions.

4. The results of the medical examinations of the two groups seem to indicate that the general physical well-being of the LG group is superior to that of the HG group.

IV — MEDICAL HISTORY

The medical history, which was filled out by the student as a part of his physical examination, consisted of a series of questions divided among the following systems: Gastro-intestinal, cardiac, respiratory, genito-urinary, nervous, and muscular and osseous. In no system did the answers to any of the single questions show a marked difference between the HG and the LG groups. The two groups diverged only in the total number of complaints listed under a single system.

Summary

1. The two groups were compared upon the basis of their medical histories. No significant differences were found in the answers to any individual questions nor in the kind or number of diseases listed in their disease history.

2. In every system the LG group indicated more complaints than the HG group, but the difference in number of complaints was significant only in the genito-urinary system, where the LG group listed nearly three times the number indicated by the HG group, and in the cardiac, where 71 per cent indicated one or more complaints as compared to 45 per cent listed by the HG group.

V — SOCIAL HISTORY

As a part of his medical history each student filled out a social history which consisted of a series of questions covering those social and personal factors which might be of importance in

diagnosing any physical ailment. These were examined for the purpose of finding any additional factors conditioning scholastic success. A brief resumé of the questions and their answers follows:

Stimulants. — “How much coffee, tea, tobacco, and alcohol do you use?” This question was answered by parts. Of the HG group 40 per cent as compared to 14 per cent of the LG group used no coffee. Tea was used by so few of either group that the answers were not significant. Tobacco was used by 25 per cent of the HG group and 65 per cent of the LG group. All of the HG group who answered the question denied the use of alcohol, although 19 per cent did not answer. Of the LG group 21 per cent of those answering the question acknowledged the use of alcohol, while 75 per cent of the group did not answer.

Walk to school. — In the answers to the question “How far do you walk to school?” The general tendency was for the LG group to room closer to the campus than the HG group.

Sleep. — On the average number of hours of sleep obtained by the members of the two groups there were no differences.

High School standing. — There was a marked difference between the two groups in their answers to the question “What was your relative High School standing?” From their own estimation of their ranks in their high school classes the HG excels the LG group to a significant degree.⁴

Sport preference. — The LG group were found to have a definite preference for participating in the major sports while the HG group preferred the minor sports. The LG group also competed in a greater number of sports than the HG group.

Fraternity. — There was a slightly greater tendency for the men in the HG group to belong to fraternities, but the difference was not great enough to be significant.

Housing. — Of the men in the LG group 44 per cent roomed alone as compared to 25 per cent of the HG group. Most of the men rooming alone gave Iowa City as their home address. As eight of the members of the LG group lived in Iowa City while only three of the HG group had their homes here, this difference is not significant for the groups as a whole. It is of significance, however, that over twice as many of the LG group as compared with the HG group attended school in their home town.

Exercise. — In their answers to the question “How much time per week (outside of the regular gym class) do you spend in physical exercise?” the HG group estimated that they averaged nearly an hour more a week in exercise than did the LG group.

⁴ For a more detailed account see Table III.

Baths. — There was no significant difference in the average number of baths a week listed by the two groups. There was a tendency for the members of the LG group to bathe either very often or very seldom. This was in direct relation to their presence or absence on an athletic squad. The tendency of the HG group was to indicate an average of two to four baths each week instead of from one to fourteen as did the LG group.

Outside work (while attending high school). — Of the men in the HG group who worked while attending high school, 75 per cent held positions requiring more mental than physical effort and 25 per cent were engaged in manual labor; in the LG group 44 per cent were in positions requiring mental effort and 56 per cent had work that required only physical labor.

Summary

1. The LG group used more coffee, tobacco and alcohol than did the HG group. The LG group as a whole preferred participation in the major sports while the HG group was more interested in the minor sports.

2. The HG group roomed slightly farther from the campus than the LG group. The HG group was superior to the LG group in their own estimation of their high school standings. There was a slight tendency for more of the HG group than of the LG group to belong to fraternities. The HG group averaged an hour a week more time in physical exercise than the LG group. In high school the HG group did more outside work requiring mental effort while the LG group more often did work of a manual type.

3. The social histories of the two groups indicate that the HG group had better habits, better high school records, and were more inclined to engage in work requiring mental effort than were the LG group.

VI — CLASS ABSENCES

A comparison of the two groups on the basis of the number of times they were absent from their class in physical education was of considerable significance. The LG group were found to have more than twice the number of absences of the HG group.⁵

VII — GRADES IN PHYSICAL EDUCATION

A final comparison of the groups was made on the basis of their grades in the department of physical education. The difference between the two groups is very great. The ratio of the observed difference of the means to the probable error of the means is 18.03.⁶

⁵ Note. For more detailed account see Table IV.

⁶ Note. For a more detailed result see Table V.

VIII — GENERAL SURVEY

Two groups of freshman men, the highest and lowest in scholastic standing during the first semester of the school year 1925-26, were selected. Fifty-two men were in the high grade group and fifty-four men in the low grade group. A comparison of these two on the basis of their records in the Department of Physical Education for Men (State University of Iowa) was made for the purpose of discovering any items in the records which are of significance in relation to scholastic success.

The two groups were found to differ on many of the items. Some of the differences were great enough to be apparently significant of themselves. Other items were found where the difference between the two groups on each individual item was so small that the difference was not significant for the individual item, yet the many slight differences on similar items would indicate that the differences while slight may be significant.

The men in the HG group were younger. Their anthropometric measurements of size were smaller than those of the LG group. They did almost as well as the LG group in the physical efficiency tests, and the slight difference found may be attributed to the age difference. The HG group listed fewer complaints than the LG group in their medical histories although their general physical condition was slightly poorer. The attendance of the HG group was more regular than that of the LG group. On the final criterion of success or failure the HG group received grades markedly better than those of the LG group.

It therefore seems probable that there are some factors determining success in physical education which are also of importance in their relationship to scholastic achievement.

IX — CONCLUSIONS

1. Records in the Department of Physical Education for Men show that success or failure in this department is controlled largely by the same factors that condition academic success in the University.

2. Men scholastically successful also excel in their work in physical education because they make more efficient use of their bodies than do those whose academic standing is low, although the latter are older, larger and stronger.

Table 1—Anthropometric Measurements

	HIGH GROUP				LOW GROUP				
	N	M	SD	PE _m	N	M	SD	PE _m	RATIO
Age	45	18.85	1.52	.15	48	19.65	1.43	.14	3.90
Weight	45	137.44	16.89	1.70	48	152.90	18.64	1.81	6.22
Height	44	68.57	2.42	.25	47	68.69	3.12	.30	.30
Neck	44	14.00	1.47	.07	48	14.57	.87	.08	5.23
Chest (contracted)	44	33.39	1.97	.20	48	35.02	2.15	.21	5.64
Chest expansion	44	2.99	.95	.96	48	2.92	.83	.81	.55
Right upper arm	44	10.39	.80	.08	48	11.04	1.14	.11	4.78
Right biceps	44	1.54	.40	.04	48	1.57	.54	.05	.53
Waist	44	29.09	2.26	.23	48	30.60	2.55	.25	4.45
Right thigh	44	20.30	1.47	.15	48	20.99	1.95	.19	2.88
Right leg	44	13.88	.93	.09	48	14.60	1.07	.10	5.22
Lung capacity	44	243.18	30.39	3.08	48	252.29	38.55	3.75	1.87
Right grip	44	85.85	19.25	1.96	48	93.25	16.80	1.64	2.90
Left grip	44	75.30	15.77	1.60	48	82.41	20.51	2.00	2.77
Back lift	44	295.00	26.80	5.45	48	320.00	30.96	6.23	3.02
Back and leg lift	44	417.90	89.40	9.09	48	446.25	102.57	9.99	2.10
Dips	44	4.98	3.58	.36	48	6.09	3.77	.37	.15
Chins	44	6.29	2.85	.29	48	7.96	2.53	.25	4.36

N—Number of cases. M—Mean. SD—Standard Deviation. PE_m—Probable Error of the Mean. Ratio—Ratio of the observed difference to the probable error of the difference of the two means.

Table II—Physical Efficiency Tests

	HIGH GROUP				LOW GROUP				
	N	M	SD	PE _m	N	M	SD	PE _m	RATIO
Fence vault	45	1.89	2.51	.252	42	2.40	2.31	.243	1.47
Rope climb	39	2.51	1.64	.177	42	3.00	1.56	.162	2.04
High jump	38	2.47	1.14	.125	39	2.92	1.31	.141	2.39
Dips	41	1.88	1.33	.140	41	2.00	1.14	.120	.65
Chins	37	2.03	1.26	.140	41	2.37	1.05	.111	1.90
Broad jump	35	.83	.31	.035	38	1.48	1.31	.144	4.39
Forty yard swim	31	.23	.15	.019	32	.19	.15	.017	.29
Posture	35	2.28	.24	.028	39	2.31	.26	.029	1.28

N—Number of men in group participating.
M—Mean of the points obtained by group on the scale from 4 to 0.
SD—Standard deviation.
PE_m—Probable error of the mean.

Table III—Relative High School Standing

	HIGH GROUP		LOW GROUP	
	N	PER CENT	N	PER CENT
Did not answer	3	5.9	19	35.2
Very good	26	51.0	1	1.9
Good	20	39.2	16	29.6
Fair	2	3.9	17	31.4
Poor			1	1.9

Tables IV and V — Absences and Grades

Table IV			Table V				
	HIGH GROUP	LOW GROUP	HIGH GROUP		LOW GROUP		
			N	PER CENT	N	PER CENT	
Number	47	53	A	4	7.8	1	1.9
Mean	1.02	2.81	B	14	27.4	7	13.5
Standard Deviation	1.56	3.68	C	21	41.2	11	21.1
Probable Error mean	0.217	0.341	D	6	11.8	5	9.6
Ratio of the observed difference to the probable error of the difference of the means-----		4.23	Inc.	2	3.9	8	15.4
			Cond.	1	2.0	12	23.1
			Fd.			8	15.4
			Exc.	3	5.9		
			Total	51		52	
			M	-2.68	.96	PE _m	.094
			SD	1.00	1.76	Ratio	18.03

The grades have the same significance as in the other courses in the University. Excused (Exc.) is considered as passing work, and has been included in the Table as a grade of "C."