

SOME OF THE CAUSAL FACTORS IN
THE INCREASED HEIGHT OF
COLLEGE WOMEN

THIRD NOTE

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College women during the last three decades have increased in size. The studies¹ made at Stanford University of 4,170 women students who entered during a period of thirty years show at the time of admission not only an increase in weight but also an increase of 1.2 inches in average height. These results have been confirmed by the Vassar College statistics² based on the examinations of 7,064 women during thirty-seven years, an investigation which shows an increase in height "well over 1.5 inches"; and also by Smith College measurements³ of 10,149 women during a period of twenty-two years.

Table 1 gives the data concerning height for Stanford University, Vassar College and Smith College individually in year groups, with the number of cases, and the average height for each year, and also shows the same data for 21,383 women, the combined examinations from the three institutions.

Table 2 gives the same data for Stanford women by decades.

Consideration of the average height of college women either separately in terms of the individual college and university group, or in terms of the measurements of the 21,383 examinations of women from Stanford, Vassar and Smith combined, shows the same

1. Mosher, C. D.: Concerning the Size of Women, Preliminary Note, California State J. Med. **19**: 53 (Feb.) 1921; The Height of College Women, Second Note, M. Woman's J., November, 1921.

2. Newcomer, Mabel: The Physical Development of Vassar College Students, 1884-1920, Quart. Pub. Am. Stat. A., December, 1921.

3. Smith College Statistics, New York Herald, May 9, 1921. These were submitted to Miss Elizabeth Richards of Smith College for correction and approval, after having been arranged to correspond to the Stanford and Vassar figures.

increase (Table 1). We may therefore conclude that college women have increased in average height 1.2 inches or more in the last thirty years.

A careful study of the 4,170 women who entered Stanford University during the last three decades shows that while the range in height has remained

TABLE 1.—Height of 21,533 College Women by Years*

College Year	Stanford University		Smith College		Vassar College		Stanford, Smith and Vassar Combined (21,388)	
	No. of Women	Average Height, Inches	No. of Women	Average Height, Inches	No. of Women	Average Height, Inches	No. of Women	Average Height, Inches
1884-1885	...	...	...	...	30	63.5	...	...
1885-1886	...	...	...	...	39	62.8	...	...
1886-1887	...	...	...	...	31	62.5	...	...
1887-1888	...	...	...	...	44	63.5	...	...
1888-1889	...	...	...	...	52	62.9	...	...
1889-1890	...	...	...	...	59	63.4	...	...
1890-1891	...	...	...	...	51	63.4	...	...
1891-1892	94	62.4	...	...	113	63.1	207	62.8
1892-1893	91	63.2	...	...	127	63.0	218	63.1
1893-1894	89	63.0	...	...	129	63.1	218	63.0
1894-1895	124	63.3	...	...	105	63.4	229	63.4
1895-1896	108	63.0	...	...	146	63.0	254	63.0
1896-1897	127	63.4	...	...	164	63.5	291	63.4
1897-1898	124	63.2	...	...	201	63.5	325	63.4
1898-1899	124	63.2	...	...	185	63.5	309	63.4
1899-1900	117	63.5	300	63.2	218	63.6	635	63.4
1900-1901	118	63.4	335	63.6	222	63.8	675	63.6
1901-1902	104	63.8	262	63.5	290	63.9	656	63.7
1902-1903	150	63.8	309	63.6	220	63.7	679	63.7
1903-1904	102	64.9	307	63.7	207	64.2	616	64.2
1904-1905	39	62.9	403	63.3	247	64.0	689	63.4
1905-1906	78	63.5	406	63.6	208	63.8	692	63.6
1906-1907	158	63.8	469	63.0	160	64.0	787	63.6
1907-1908	180	63.6	445	63.2	295	63.8	920	63.5
1908-1909	63	63.5	494	60.9	286	64.2	843	62.9
1909-1910	133	63.9	501	62.4	260	64.2	894	63.8
1910-1911	133	63.6	454	63.5	267	63.8	914	63.6
1911-1912	131	63.8	414	63.8	256	64.3	801	63.9
1912-1913	91	63.7	480	63.2	276	64.1	847	63.7
1913-1914	146	63.7	498	63.6	296	64.2	940	63.8
1914-1915	168	63.9	545	63.6	343	64.1	1,056	63.9
1915-1916	178	63.7	526	63.7	303	64.2	1,007	63.8
1916-1917	170	64.0	642	63.6	227	64.1	1,039	63.9
1917-1918	238	64.2	646	64.1	241	64.4	1,125	64.2
1918-1919	276	63.8	730	64.3	228	64.5	1,234	64.2
1919-1920	157	63.6	479	64.1	242	64.4	878	64.0
1920-1921	299	64.0	504	64.0	296	64.7	1,099	64.2

* Stanford, 4,170; Smith, 10,149; Vassar, 7,064.

about the same (14 inches), there has been an increasing number of women in the upper end of the series; or, in other words, while there are women coming to the university just as short in height as during the first decade, their number is decreasing, while at the same time the number of tall girls is increasing. Not every woman has gained in height 1.2 inches, but an increas-

ing number of women who are tall are entering the university.

EXPLANATIONS FOR INCREASED HEIGHT OF
WOMEN

Is the increase in height during these later years due to the greater admixture of the northern races through immigration? This does not appear to be the case.

The arguments against this are several. First, this increase in height is found in a western university and in two eastern colleges. There is a greater increase in the Vassar height than in the height of the Stanford women. Although the Smith records show a somewhat smaller average increase, yet these records extend over twenty-two years, only a little more than the last two decades, and at both Stanford and Vassar the increase in average height is greater from the first to the second decade than from the second decade to the

TABLE 2.—Average Height of 4,170 Stanford University Women by Ten-Year Periods (from Table 1)

Years in 10-Year Periods	Number of Women	Average Height, Inches
1891-1892 to 1900-1901 (inclusive).....	1,116	63.2
1901-1902 to 1910-1911 (inclusive).....	1,200	63.6
1911-1912 to 1920-1921 (inclusive).....	1,854	63.9

third. Moreover, the study of the birthplaces of the Stanford women shows that these women are a cross section of the college women of the United States and not a localized group (Table 3). Every state in the Union, with the exception of North Carolina and Delaware, is represented, only about 37 per cent. being from California. There are 135 from the New England states and 127 from Oregon and Washington; 248 from the Middle Atlantic states, as contrasted with 297 from the Mountain states; the Southern states show a smaller attendance in college—the South Atlantic having forty-three, and the East South Central forty-six, together having eighty-nine representatives at Stanford, as contrasted with the West South Central states, with seventy-four daughters in the university; the East North Central states, which have 695 students, are not far away from the West North Central states, which have 703 students, only eight more than in the previous division. Again, may not the question be raised

TABLE 3.—Birthplaces of 4,170 Stanford Women by Decades

New England States (135)				Pacifi States (1,704)			
	First Decade	Second Decade	Third Decade		First Decade	Second Decade	Third Decade
Connecticut....	8	5	13	California.....	364	440	763
Maine.....	13	9	11	Oregon.....	29	16	35
Massachusetts..	21	14	19	Washington...	11	16	30
N. Hampshire..	4	3	1				
Rhode Island..	2	1	2				
Vermont.....	6	2	1				
Total No.	54	34	47	Total No.	404	472	828
Middle Atlantic States (248)				Mountain States (297)			
	First Decade	Second Decade	Third Decade		First Decade	Second Decade	Third Decade
New Jersey.....	5	10	11	Arizona.....	2	7	15
New York.....	67	36	36	Colorado.....	8	29	61
Pennsylvania..	32	22	29	Idaho.....	2	6	17
				Montana.....	4	16	27
				Nevada.....	19	10	9
				New Mexico....	4	4	3
				Utah.....	3	11	26
				Wyoming.....	4	2	8
Total No.	104	68	76	Total No.	46	85	166
South Atlantic States (43)				East South Central States (46)			
	First Decade	Second Decade	Third Decade		First Decade	Second Decade	Third Decade
Dist. Columbia	4	4	5	Alabama.....	2	1	1
Florida.....	0	2	1	Kentucky.....	9	6	7
Georgia.....	1	3	1	Missouri.....	4	1	1
Maryland.....	1	3	3	Tennessee.....	2	3	7
So. Carolina...	1	0	2				
Virginia.....	5	1	1				
W. Virginia....	1	2	2				
Total No.	13	15	15	Total No.	17	11	20
East North Central States (695)				West North Central States (703)			
	First Decade	Second Decade	Third Decade		First Decade	Second Decade	Third Decade
Illinois.....	89	70	106	Iowa.....	71	82	94
Indiana.....	48	29	50	Kansas.....	24	40	54
Michigan.....	23	23	34	Minnesota.....	19	20	55
Ohio.....	47	47	29	Missouri.....	24	37	42
Wisconsin.....	37	24	37	Nebraska.....	10	32	48
				N. & S. Dakota	1	20	30
Total No.	244	193	258	Total No.	149	231	323
West South Central States (74)				Foreign Born			
	First Decade	Second Decade	Third Decade		First Decade	Second Decade	Third Decade
Arkansas.....	3	6	5	Alaska.....	0	1	1
Louisiana.....	3	2	2	Hawaii.....	2	6	2
Oklahoma.....	0	0	7	Foreign.....	56	32	53
Texas.....	3	10	33	Unknown.....	18	34	20
Total No.	9	18	47	Total No.	76	73	76

whether the daughters of parents born in other countries are able to go to college in any very great numbers in the first generation? The answer seems to be in the negative; certainly they do not go in sufficient proportion to influence the height in a consideration of 21,383 women who are represented in this study.

It is therefore evident that we must seek some other explanation for the increased height of women than either a greater percentage of the northern races due to immigration, or the presence of westerners who are known to be on the average somewhat taller than eastern people.

It is quite true that the average height of California women is slightly greater than the height of non-

TABLE 4.—*Height of Californians and Non-Californians by Decades**

Ten-Year Groups	Californians		Non-Californians		Total Birth-places known; of Non-Californians	Un-known; of Women
	No of Women	Average Height, Inches	Average Height, Inches	No. of Women		
1891-1892 to 1900-1901 (inclusive)	364	63.4	63.0	745	1,109	7
1901-1902 to 1910-1911 (inclusive)	440	63.8	63.7	722	1,162	38
1911-1912 to 1920-1921 (inclusive)	763	63.9	63.8	1,072	1,835	19
Total.....	1,567	63.7	63.5	2,539	4,106	64

* Eight women were known to be non-Californians but the birth state was unknown. Thus there is a discrepancy in Tables 3 and 4 in the number of unknown birthplaces.

California women, as shown in Table 4. But the inclusion of a greater number of Californians in the later decades will not account for the increase in height, for it will be noted that the non-Californians increased in height to a much greater extent than did the Californians. That the non-Californians have shown a greater increase in height than have the Californians is an indirect proof of the contention that exercise and more hygienic clothing are among the causal factors in the development of this finer physical type of woman. The outdoor life with its tramping, climbing, riding and exercise in the open was common to women to a much greater degree in California in the first decade than in the eastern United States. Certainly bicycling, which was one of the chief forms of athletics in the

first decade, was almost universal at Stanford, where the limited means of transportation made it an essential to every-day living during those pioneer days. With bicycling came the necessity for shorter, lighter and looser clothing. It became imperative to discard the voluminous skirts measuring from 9 to 15 feet in diameter, which often weighed as much as 7 pounds,⁴ and thus here and there some venturesome college girl tried something in the way of dress which was the forerunner of the sport suit of today.

In my first paper, "Concerning the Size of Women,"¹ it was stated after a general survey of all the available data that two great factors are concerned in these results: (1) the change in fashion, making possible the wearing of clothing which interferes less with the hygiene of the woman (2) the increased physical activity, which has been brought about by the (a) change in dress; (b) development of physical training and sports in the secondary schools as well as in our colleges, and (c) change in the conventional attitude toward these activities for women.

INCREASED PHYSICAL ACTIVITY OF WOMEN

Let us consider, first, the increased physical activity of women. It is a matter of common knowledge that the modern college girl is more physically active than the women of thirty years ago, but the Vassar studies make a real contribution to this subject. From 1896 to 1900, 26.5 per cent. of the entering students at Vassar College had engaged in no form of sport before coming to college; from 1916 to 1920, only 0.6 per cent. reported no sports before admission to the college. This almost universal physical activity during the preparatory years has been fostered, not only by the laws for compulsory physical training in the secondary schools, but also by the municipal play grounds and swimming pools. This eagerly to be desired, more fully developed woman will, therefore, be found in constantly increasing numbers among all classes of women, those who go to college and those who do not go, thus insuring better wives and mothers, and consequently a better race.

4. Mosher, C. D.: Health and the Woman Movement, Ed. 2, New York, Woman's Press, 1918, p. 22.

INFLUENCE OF FASHION

The other factor is the influence of fashion. It has already been noted that, with increasing physical activity, a change to lighter and looser clothing was made and fashion was forced to adapt itself to the introduction of the bicycle and automobile. The changes in fashion have been studied by A. L. Kroeber,⁵ the anthropologist, who has traced these variations over a period of more than sixty years. His figures for twenty-nine years of the period covered by the Stanford measurements have been plotted in curves. The ratios given for the width of skirt, the length of skirt, and the width of waist throw some light on the problem of the relation of change in fashion to increased height and functional disability, as shown by the Stanford studies on these two subjects.

The detailed curves after Kroeber are given, and also the average curve, which shows even more clearly the gradual narrowing and shortening of the skirt and at the same time the increased breadth of waist.

In any consideration of the advantages to the health of women in the narrowing and shortening of the skirt, we must bear in mind that I am not referring to such vagaries of fashion as are represented in the detailed curve for the year 1911, and again in 1920, developments which would be just as hampering to freedom of motion as were the heavy, voluminous skirts, although the excessive narrowness was compensated for in part, at least, by an equally and unduly excessive shortening. These very extreme styles were of relatively short duration and therefore of minor significance. The trend of the curve, when studied in connection with the Stanford curves for periodic disability and height, shows an unmistakable parallel.

Reliable data on the menstrual conditions of the women at Stanford were available only for the years 1893, 1894, 1895, 1912, 1913, 1914, 1915, 1916 and 1917. In an earlier paper I discussed the unreliability of general statements about the menstrual function as collected from the women concerning themselves.⁶ The

5. Kroeber, A. L.: On the Principle of Order in Civilization as Exemplified by Changes in Fashion, *Am. Anthropologist* 21: 235-263, 1919.

6. Mosher, C. D.: Functional Periodicity in Women and Some of the Modifying Factors, Second Note, *California State J. Med.*, January and February, 1911; *M. Woman's J.*, April, 1911; *Am. Phys. Ed. Rev.*, November, 1911.

records for the years mentioned I can personally vouch for as being as reliable as single statements can be made. No case in which there was pain has been overlooked. The close relation between these changes in fashion and the relief from menstrual pain is obvious. This relation has been repeatedly shown in my clinical experience, but lack of space prevents the citing of cases. The evil effect of heavy clothing is also reflected in the percentage of pain at the menstrual period, as shown in the Stanford no dysmenorrhea curve, which from 1911 to 1917 steadily rises, until in 1915 and 1916

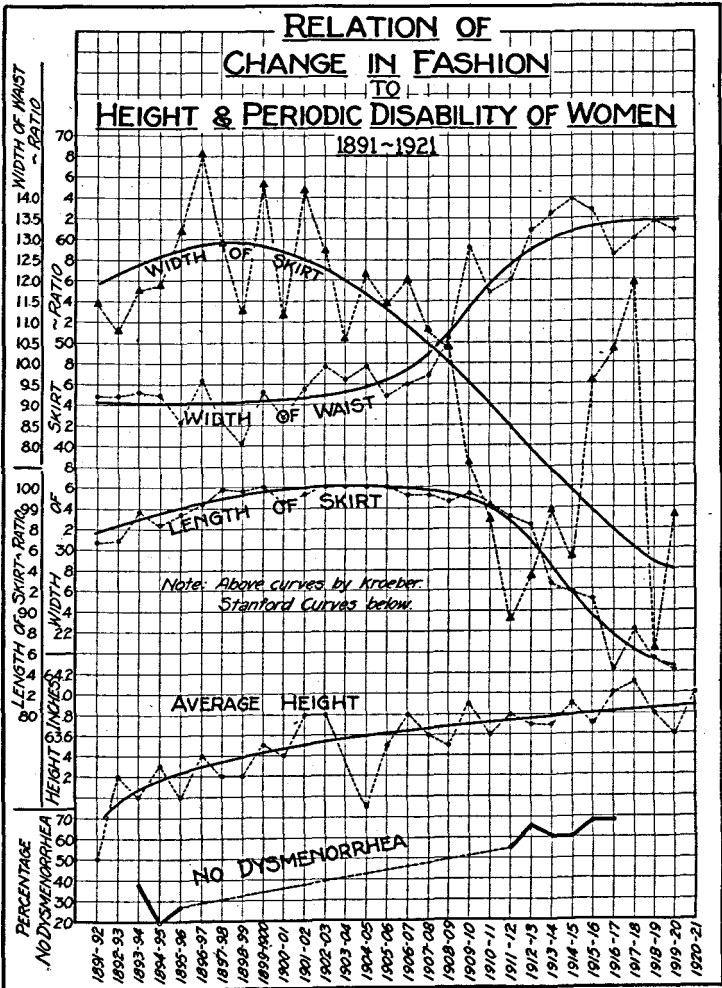
TABLE 5.—*Arithmetical Means of Girth of Waist of Vassar College Students, 1884-1920**

Year	No. of Women	Mean, Cm.	Standard Deviation, Cm.	Year	No. of Women	Mean, Cm.	Standard Deviation, Cm.
1884.....	30	65.2	4.6	1903.....	206	60.5	4.9
1885.....	39	63.2	3.6	1904.....	248	59.0	4.8
1886.....	31	62.7	6.4	1905.....	208	60.0	4.6
1887.....	44	62.7	4.3	1906.....	160	61.5	5.4
1888.....	53	62.9	3.8	1907.....	293	61.2	5.5
1889.....	59	62.7	3.9	1908.....	283	61.0	5.1
1890.....	51	62.1	4.9	1909.....	267	63.8	5.5
1891.....	112	63.0	4.5	1910.....	263	63.3	5.0
1892.....	127	62.6	3.6	1911.....	254	63.8	4.9
1893.....	127	62.7	4.0	1912.....	274	63.9	5.2
1894.....	107	62.5	5.1	1913.....	297	63.9	4.5
1895.....	146	62.7	4.4	1914.....	340	65.4	4.4
1896.....	160	59.6	4.2	1915.....	307	65.6	5.0
1897.....	199	60.2	4.1	1916.....	227	65.6	4.7
1898.....	183	60.9	4.8	1917.....	239	64.9	4.3
1899.....	216	61.2	4.8	1918.....	...	...	...
1900.....	223	61.0	4.4	1919.....	240	65.1	4.4
1901.....	253	60.6	4.5	1920.....	296	65.3	4.1
1902.....	220	60.8	4.5				
Total.....					6,812	62.7	5.1

* Newcomer, Mabel: *The Physical Development of Vassar College Students, 1884-1920*, p. 979.

it shows that 68 per cent. of the women were free from pain at the time of menstruation—a great contrast to 1894, when there were but 19 per cent who did not suffer pain at their menstrual periods.

The Vassar investigation in regard to the girth of waist is shown in Table 5. It will be noted that there was a steady decrease in the girth of waist up to 1904, and a steady increase from 1904 to the present time. This is readily explained by the study of Dr. Kroeber's curve for breadth of waist given in the accompanying chart. As breadth of waist is a fair indicator of the degree of compression, it is not surprising that the demand of fashion for a small waist should be evident



Relation of change in fashion to height and periodic disability of women, 1891-1921.

in the ratio of less than 0.5 up to 1904, while as this demand gradually lessened, the ratio changed to 3.5 from 1905 to 1919. The ratios should be correlated with a decreasing girth of waist as a result of continuous compression over a period of years. When the demand of fashion for a small waist finally ceased, the increase in width of waist occurred, as shown in the curve from 1904 to 1921. To this is related the increase previously considered in the number of women who do not suffer pain at menstruation.

RELATION OF CHANGE IN FASHION TO INCREASED HEIGHT

How is this change in fashion, which permits more normal functioning and greater freedom of exercise, related to increased height?

One of the serious problems in regard to college girls during the early days was how to induce these delicate, undeveloped women to eat enough nourishing food. The girl of this first decade lacked appetite. The vigorous modern girl, physically fit, eats in season and out, and is as hard to satisfy as a growing boy—and for the same reason: the body is working normally and needs more food for growth and development. Here we find a reasonable explanation of the fact that the woman not only functions more perfectly, but weighs more and is growing taller, while, as was demonstrated in 1917, the difference in muscular strength⁷ between men and women is due to the difference in use of muscles and not to sex.

This more fully developed and more perfectly functioning woman is well fitted for motherhood, while her desire for children is shown by the fact that she no sooner comes out from under the anesthetic at one labor than she begins to plan for the coming of her next baby.

In this age, when questions of population and the falling birth rate are of such vital import, it behooves us to give attention to every factor that has any bearing on this subject.

It is time that we ceased thinking in terms of the unfitness and weakness of women. This splendid

7. Mosher, C. D., and Martin, E. G.: Muscular Strength of College Women, *J. A. M. A.* **70**: 140 (Jan. 19) 1918. *The Strength of Women, Proceedings of the International Conference of Women Physicians* **1**: 160, 1919.

modern woman, grown taller and more vigorous because, freed from restricting fashions of dress, she exercises more and consequently eats more, has become better fitted to be the mother of finer sons and daughters, the promise of a stronger race.

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