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Research Article

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Proposal for a New Sports Talent Identification System Based on the Tracking Phenomenon of Height

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Abstract

In sports talent discovery in Japan, a system has been built to effectively support athletes with contact maintained between regional and central sports organizations. However, while a certain effect has been achieved with this system, much still depends on tacit knowledge. That is, a discovery system based on scientific evidence has not yet been established. The system is especially lagging in terms of approaches from the field of growth and development research. The only such approach, as found by Fujii, is that height and athletic ability are independent phenomena, and if one wants to discover exceptional sports talent it is necessary to think about height and athletic ability independently. In this study, we attempted to analyze the tracking of tall and short heights in the junior (school-age) period from the perspective of physical growth science, by applying the application of the wavelet interpolation model. The results showed that a tracking phenomenon is seen with a high probability (about 90%) for both tall and short heights. This makes it possible to identify who will be tall and short in the future. Assessing the athletic ability of tall and short people independently and proposing a system that screens for people with high athletic ability can contribute to building a new system for the discovery of sports talent.

Keywords: Wavelet Interpolation Model, Sports Talent, Tracking Phenomenon, Height

Introduction

The sports talent discovery business in Japan has produced many top-level athletes, as is clear from a look at recent Olympics [1,2]. However, while this discovery system has achieved a certain effectiveness, the many aspects that still rely on tacit knowledge are a problem. In other words, a discovery system based on scientific evidence has not yet been established.

A high level of athletic ability is obviously important as a physical element of elite sports, and, depending on the sport, tall height is also desirable in many cases. The average height of athletes who play in Japan's top leagues or who compete in international competitions as national representatives in many sports, such as volleyball, soccer, swimming, and handball, is shown to be taller than the average Japanese height (171.06 cm) [11]. In athletes in competitions such as horse racing or gymnastics where short height is advantageous, the element of height is also important in talent discovery [8,10]. Thus, if a final tall or short height could be estimated, individuals in the discovery stage could be efficiently encouraged to play certain sports to which they are physically suited. In the field of growth and development research, Fujii has been the only researcher to state that tall height and athletic ability are independent phenomena, and that tall height is not always superior for athletic ability or an advantage in sports. In attempting to discover outstanding sports talent, therefore, height and athletic ability need to be considered independently [6]. Thus, clarifying growth patterns for tall and short height should make it easier to discover outstanding sports talent.

In this study, we applied the wavelet interpolation model to analyze how the talent element of tall and short height in the junior years (school-age years) tracks from a growth perspective, and attempted to propose a sports talent discovery system based on scientific evidence.

Methods

Subjects and Measurements

The subjects in this study were 4,922 males and 4,685 females born in 1994-1995 for whom continuous height growth data from the first year of elementary school to the third year of middle school (ninth grade) were obtained. Table 1 shows the data obtained in cohorts for the mean height and standard deviation of the study

subjects, and the national mean height and standard deviation published by the Ministry of Education, Culture, Sports, Science and Technology for those born in the 1994 and 1995 academic years. From this table, it is seen that the height of the subjects in each academic year in this study is similar to the national mean values, and there are not thought to be any major differences with the growth status of all children nationally.

In this study, to examine the growth status for short and tall heights, the mean height and standard deviation during the third year of middle school was calculated from among the subjects. Those with the mean height −2.0 SD or below were judged to be short individuals, and those with the mean height +2.0 SD or higher were judged to be tall individuals, and taken as the subjects of analysis.

				Age (year)								
				6	7	8	9	10	11	12	13	14
Boys	Subject	Mean	cm	116.72	122.56	128.24	133.66	139.01	145.29	152.81	160.06	165.16
	N=4922	SD		4.74	4.99	5.23	5.49	5.92	6.83	7.60	7.18	6.24
	National	Mean	cm	116.95	122.87	128.24	133.70	138.84	145.41	152.72	159.86	165.37
	Average	SD		4.97	5.18	5.42	5.34	5.91	7.14	8.07	7.61	6.72
Girls	Subject	Mean	cm	115.77	121.58	127.37	133.48	140.11	146.77	151.73	154.64	156.09
	N=4685	SD		4.88	5.15	5.55	6.16	6.82	6.70	5.87	5.43	5.35
	National	Mean	cm	115.98	121.63	127.55	134.02	140.53	146.67	152.19	155.10	156.79
	Average	SD		4.82	4.96	5.39	5.91	6.75	6.92	5.70	5.39	5.23

Table 1: Mean height and standard deviation in the subject and nationally.

Construction of a Longitudinal Aging Evaluation Chart

In this study, we analyzed how height changed in those judged to have short and tall height in the growth stage from the first year of elementary school to the third year of middle school. For that purpose, it was necessary to create an evaluation chart that could evaluate height at each age. We applied the wavelet interpolation model to the mean value, mean value ±0.5 SD, and mean value ±1.5 SD for height in each school year. Wavelet interpolation can approximately describe true growth curves from obtained growth data unaffected by the order [3-5]. To do that, data are interpolated with a wavelet function and a growth distance curve is drawn. Through these procedures, a longitudinal aging evaluation chart for height is constructed. The evaluation range of +1.5 SD or more was taken as "tall height," from mean +0.5 SD to less than the mean +1.5 SD as "somewhat tall height," from mean −0.5 SD to less than mean −0.5 SD as "standard height," from −1.5 SD to less than mean −0.5 SD as "somewhat short height," and less than the mean −1.5 SD as "short height." Figures 1 is the longitudinal aging growth evaluation charts for males constructed in this study. The individual longitudinal data were then applied to the constructed evaluation charts, and how those data changed the evaluation ranges was analyzed.

Analysis Procedure

To classify how the longitudinal data for each of the tall individuals changed the evaluation ranges, in this study individuals judged to be tall in all years from the first year of elementary school to the second year of middle school were classified in a "tall → tall" group, those who were judged to be somewhat tall even once were classified in a "somewhat tall → tall" group, those who were judged to be standard even once were classified in a "standard → tall" group, those who were judged to be somewhat short even once were classified in a "short → tall" group, and those judged to be short even once were classified in a "short → tall" group.

Similarly, to classify how the longitudinal data of each individual among the short people changed the evaluation range, in this study those who were judged to be short in all years from the first year of elementary school to the third year of middle school were classified in a "short → short" group, those judged to be somewhat short even once were classified in a "somewhat short → short" group, those judged to be standard even once were classified in a "standard → short" group, those judged to be somewhat tall even once were classified in a "somewhat tall → short" group, and those judged to be tall even once were classified in a "tall → short" group.

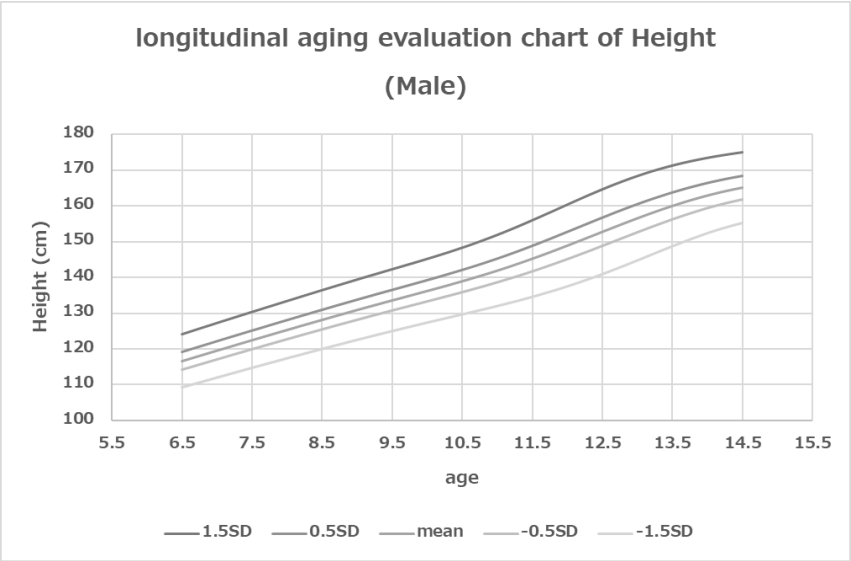

Figure 1: Longitudinal Aging and Development Evaluation Chart for Males by Wavelet Interpolation Method.

				Age (year)								
				6	7	8	9	10	11	12	13	14
Short Type	Boys	Mean	cm	109.97	115.01	120.10	125.03	129.51	134.16	138.89	144.65	150.31
	N=149	SD		3.21	2.90	2.97	3.02	3.04	2.96	3.09	3.30	1.77
	Girls	Mean	cm	107.28	112.62	117.66	123.30	129.11	134.82	139.40	142.12	143.67
	N=101	SD		3.43	3.62	3.91	4.74	5.23	4.73	3.31	2.01	1.37
Tall Type	Boys	Mean	cm	125.90	132.43	138.90	144.92	150.82	158.65	167.70	174.95	179.27
	N=88	SD		3.53	3.51	3.61	3.69	3.73	4.27	4.46	2.82	1.46
	Girls	Mean	cm	122.96	129.52	135.72	142.12	149.00	156.59	162.81	166.50	168.52
	N=93	SD		3.71	3.33	3.52	3.78	4.52	4.32	3.00	1.90	1.73

Table 2: Basic statistics of tall and short people.

Results

Basic Statistics of Tall and Short People

Table 2 shows the number of people judged to be short and tall in this study and the mean height in each year. First, the number of males judged to be short was 149 (mean height of 150.3±1.8 cm in the third year of middle school) and the number of females judged to be short was 101 (mean height of 143.7±1.4 cm in the third year of middle school). The number of males judged to be tall (mean height of 179.27±1.46 cm in the third year of middle school) was 88, and the number of females judged to be tall (mean height of 168.52±1.73 cm in the third year of middle school) was 93.

Tracking Characteristics of People with Short Height

Figure 2 shows the mean values for each year in the short group fit to the evaluation chart prepared in this study. From this figure it is seen that for both males and females the mean values remained in the short height evaluation range for nearly all years from the first year of elementary school to the third year of middle school. However, this is looking at averages only, and the height growth status with age differs among individuals. We then classified how the growth status changed with age for each individual by how the evaluation range changed.

Figure 3 shows the percentages of people classified in each group. Among males, 36.91% (55/149 males) were in the "short → short" group, 51.68% (77/149) in the "somewhat short → short" group, 10.74% (16/149) in the "standard → short" group, 0.67% (1/149) in the "somewhat tall → short" group, and 0.00% (0/149) in the "tall → short" group. About 90% grew within the height range of below the mean −0.5 SD.

Among females, 48.51% (49/101 females) were in the "short → short" group, 38.61% (39/101) in the "somewhat short → short" group, 10.89% (11/101) in the "standard → short" group, 1.98% (2/101) in the "somewhat tall → short" group, and 0.00% (0/101) in the "tall → short" group. As with the males, about 90% grew within the height range of below the mean −0.5 SD.

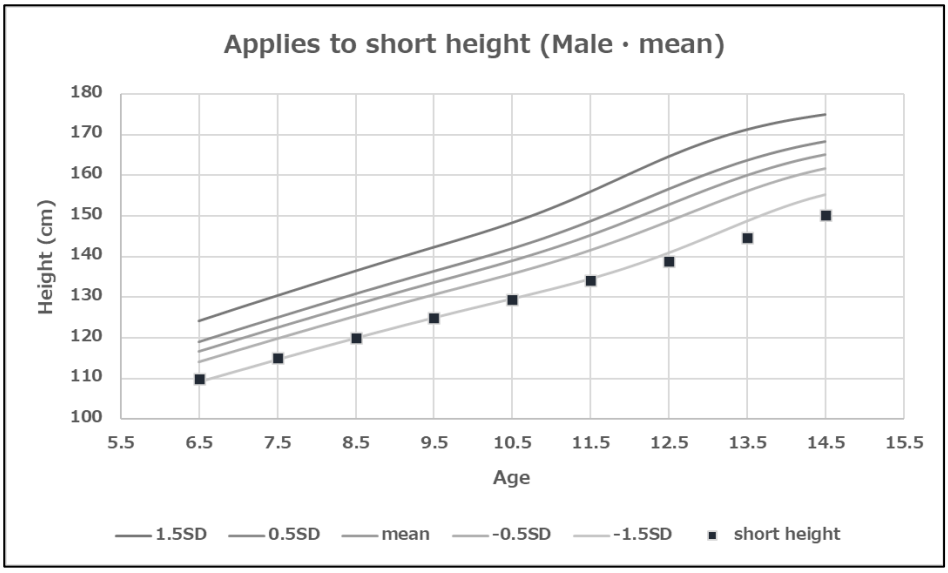

Figure 2: The tracking status for short individual of male.

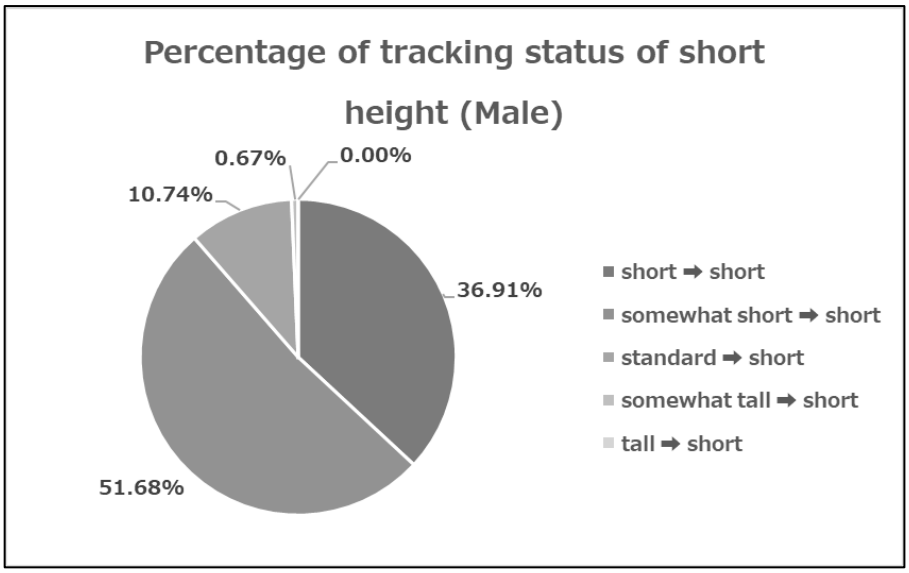

Figure 3: Percentage of tracking status of short height in males.

Tracking Characteristics of People with Tall Height

Figure 4 shows the mean values for each year in the tall group fit to the evaluation chart prepared in this study. From this figure it is seen that for both males and females the mean values remained in the tall height evaluation range for nearly all years from the first year of elementary school to the third year of middle school.

Figure 5 shows the percentages of the number of people classified in each group. Among males, 61.36% (54/88 males) in the "tall → tall" group, 32.95% (29/88) in the "somewhat tall → tall" group, 4.55% (4/88) in the "standard → tall" group, 1.14% (1/88) in the "somewhat short → tall" group, and 0.00% (0/88) in the "short → tall" group. About 90% grew within the height range of above the mean +0.5 SD.

Among females, 30.11% (28/93 females) were in the "tall → tall" group, 49.46% (46/93) in the "somewhat tall → tall" group, 16.13% (15/93) in the "standard → tall" group, 4.30% (4/93) in the "somewhat short → tall" group, and 0.00% (0/93) in the "short → tall" group. About 80% grew within the height range of above the mean +0.5 SD.

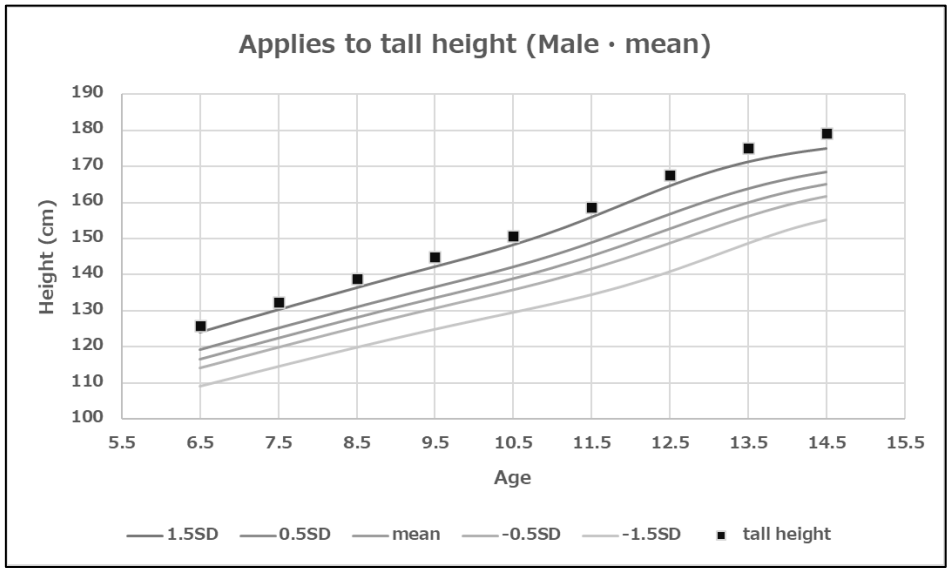

Figure 4: The tracking status for tall height of male.

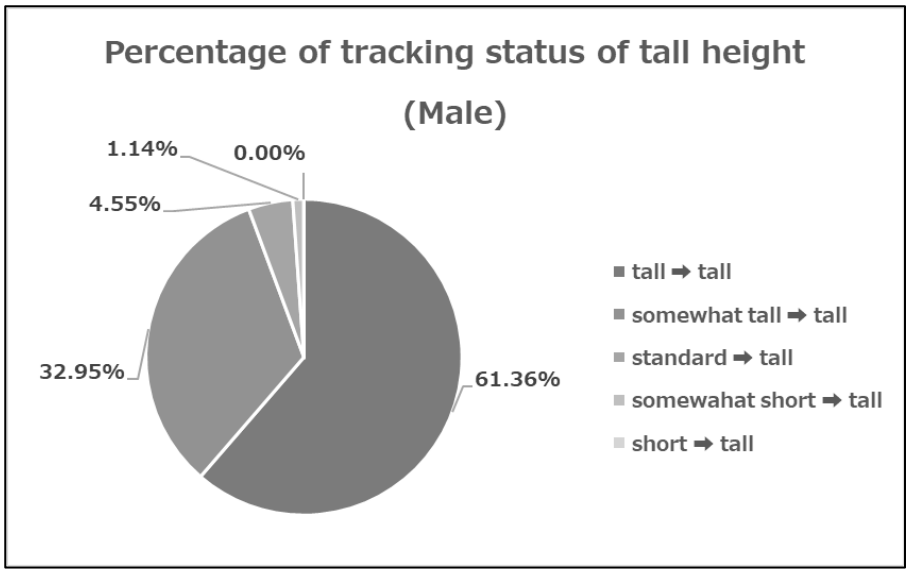

Figure 5: Percentage of tracking status of tall height in males.

Discussion

With regard to the tracking status for short height, those who remained in the "short height" evaluation range for all nine years from the first year of elementary school to the third year of middle school, and those who were judged to be "somewhat short" even one time were classified as having short height. One hundred thirty-two of the 149 males (88.59%) and 88 of the 101 females (87.12%) were classified as tracking short height. With regard to the tracking of tall height, similar to that of short height, those who remained in the "tall height" evaluation range for all nine years and those who were judged to be "somewhat tall" even once were classified as having tall height. Eighty-three of 88 males (94.31%) and 74 of 93 females (79.57%) were classified as tracking tall height. Takahashi et al [9]. (1994) examined the height changes in 163 male students for whom height data were available for 14 years, from the first year of elementary school (age 6) to the fifth year at the National Institute of Technology (age 19), and reported that of individuals judged to have short height in the first year of elementary school, 57.6% were judged to be short in the third year of middle school, while of the individuals judged to have tall height in the first year of elementary school, 51.5% were judged to be tall in the third year of middle school. Muramatsu [7] divided height measurements into a tall group, medium group and short group by a percentile method, and examined the changes with age. They reported that the percentage of people judged to be in the short group at both the first year of elementary school and the third year of middle school was 77.7% in boys and 75.5% in girls, while the percentage judged to be in the tall group was 70.3% in boys and 66.1% in girls. This study, by establishing a method to judge tracking status more clearly than previous studies, confirmed the tracking of short and

tall heights in both boys and girls from the first year of elementary school to the third year of middle school. This finding may be considered evidence showing that in tall and short people height includes a strong genetic element. Based on these findings, it may be possible to establish a system for discovery in the junior years of people who will be tall and have a high level of athletic ability, as scientific evidence in sports talent discovery in sports where tall height is an advantage. Similar discovery would be possible for sports where short height is an advantage.

Conclusion

In this study, we applied the wavelet interpolation model in an attempt to analyze from a growth perspective how the talent element of tall and short height tracked during the junior years (school-age years). The analysis results showed that growth of about 90% both boys and girls with short height in the first year of elementary school remained in the height range below the mean −0.5 SD in the third year of middle school. Of those who were tall in the first year of elementary school, about 90% of boys and 80% of girls remained in the height range above the mean +0.5 SD in the third year of middle school. From these findings, this study seems to demonstrate that the individual characteristic of height differences in the third year of middle school has already appeared in the first year of elementary school. With this, it will be possible to identify people who will have tall and short height in the future, assess the athletic ability of tall and short individuals independently, and propose a system to select individuals with a high level of athletic ability. This may contribute to building a new talent discovery system.

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