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The correlation between height and weight with performance on AAHPERD TEST among 9-18 year old boys

Mohammad Shahin[1], Mohammad Esmaeil Afzalpour[1], Zynolabedin Fallah[2] and Hamid Janani[3]

[1]Physical Education and Sport Sciences Department, University of Birjand
[2]Department of Physical Education, Gorgan Branch, Islamic Azad University, Gorgan, Iran
[3]Department of Physical Education, Tabriz Branch, Islamic Azad University, Tabriz, Iran

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ABSTRACT

The correlation between height and weight with performance on AAHPERD test among 9-18 year old boys in Qayenat (Iran) was aim of this study. Due to objective, realistic and regular characterization of the existing properties, the method of the present study is descriptive-correlational. From among the research population, a number of 300 participants (30 people at each age level) ranging in age from 9 to 18 years were randomly selected. Following the measurement of participants' height and weight, their physical fitness was tested using AAHPERD test so as to investigate the correlation between height and weight and performance in the six batteries of AAHPERD test including sit-up test, 540 m run test, pull up test (modified version), 4×9 m Agility test, 45 m sprint test and 2 Hop Jump. Then AAHPERD tests were administered to the participants in selected schools with assistance provided by physical education teachers. Correlation tests were used to analyze the data. The results showed a significant correlation between participants' height with performance and between participants' weight with performance of participants.

Key Words: Height, Weight, AAHPERD test.

INTRODUCTION

Physical fitness programs are central to physical education and sports so that practitioners and administrators of physical education pay considerable attention to them. These programs may help increase the individual and social health, improve economic status and foster socialization through the influences they exert upon individuals' health. To this end, physical education centers can play a significant role via conducting educational programs. It is no surprise that there are compulsory physical activities for people to do during daily routines in some developed countries, or that some countries take measures to foster physical growth (e.g. increase in height) in their citizens. Indeed, these countries have realized the considerable advantages of physical education and fitness to their people. Clearly, individuals with higher levels of physical fitness do better than their less fit counterparts in fulfilling their duties, which results in their higher efficiency [1-2].

Some studies have shown that physical characteristics significantly affect the individual's success in doing sport tasks [3-4]. For example, a significant correlation has been reported between the individual's height and successful performance in volleyball and basketball. As well, most weight, discus and hammer throwers have large bodies [1]. Besides, there is a common belief that students' physical characteristics significantly determine their performance in physical fitness tests (usually AAHPERD test) administered in schools in order to assess the physical education lessons. For example, a student with longer lower extremity may do more successfully than his/her peer in long

jump whereas the shorter peer may do better in agility test (4×9 m). Therefore, an investigation needs to be conducted on the relationship between height and weight and performance on AAHPERD test battery.

Many coaches and researchers seek to identify the potential factors which may improve athletic performance, to reduce adverse factors and to decide on the suitable sports for every athlete who may reach success with minimal time and energy. A significant correlation has been reported between the individual's physical characteristics and successful performance in volleyball and basketball. As well, most weight, discus and hammer throwers have large bodies [1-3].

As a prerequisite for participation in sport activities, physical fitness may be assessed through different means and tests. AAHPERD test is currently one of the most popular tests of physical fitness so that over 50% of Iranian students' scores for physical education courses are obtained through administration of AAHPERD test battery in schools. As well, similar tests are used to assess the students in Course 1 physical education in universities and to grant admission to the applicants of educational or military colleges [1]. However, there are ambiguities regarding the effects of height and weight on performance in AAHPERD test battery. Parents, head teachers and students usually hold that individuals with greater height and weight do better in the AAHPERD test.

Adequate assessment must follow appropriate principles and criteria. In other words, the respective characteristics should be tested as best as possible while the effect of unwanted factors is nullified. Height and weight are genetically bound and relate to environmental factors including nutrition, hygiene, socio-cultural status, environment and physical activity. If these two factors influence performance in physical fitness tests, they will bring about adverse results in the assessment of physical education courses in schools since they contradict educational objectives and the success may no longer be determined by endeavor, training and physical fitness but genetics and other factors. In this regard, the present study aims at investigating whether or not height and weight influence performance in AAHPERD physical fitness test battery.

MATERIALS AND METHODS

Due to objective, realistic and regular characterization of the existing properties, the method of the present study is descriptive-correlational. From among the research population, a number of 300 participants (30 people at each age level) ranging in age from 9 to 18 years were randomly selected. Following the measurement of participants' height and weight, their physical fitness was tested using AAHPERD test battery so as to investigate the correlation between height and weight and performance in the six batteries of AAHPERD test including sit-up test, 540 m run test, pull up test (modified version), 4×9 m Agility test, 45 m sprint test and 2 Hop Jump.

In order to select the research participants, Qayenat County was first divided into four regions in terms of climatic, weather and socio-economic status so that all regions (clusters) were relatively similar in terms of sport facilities, equipment and places. Based on administrative divisions, Qayenat County is divided into four regions including Central, Nimblock, Zirkouh and Paskouh regions. Subsequently, participants were selected from each cluster using simple random sampling according to the population of each division, and the number of schools.

In order to collect the data, a table was compiled which included the name of every participant and 9 columns to include age, height, and weight and the results of performance in the six batteries of AAHPERD test. Assisted by eight interns of healthcare centers, the researcher could measure and record the height and weight of all participants. Then AAHPERD tests were administered to the participants in selected schools with assistance provided by physical education teachers. Correlation tests were used to analyze the data. In this regard, Kolmogorov-Smirnov test was first run to assure the normality of the data. Pearson correlation and Spearman correlation tests were run to examine the significance of the correlation for the data normally distributed and abnormally distributed, respectively.

RESULTS

Kolmogorov-Smirnov test was used to examine the normality of every set of data. The results of this test showed that the majority of data sets are normally distributed. The parametric test of Pearson correlation was used when the data was normal and non-parametric test of Spearman correlation was used in case the data was not normally distributed.

The results of the tests of correlation between participants' height and performance in AAHPERD test battery

Table 1. The results of correlation tests between participants' height and performance in AAHPERD test

Statistic Age	45 m sprint Test	540 m run Test	Agility Test	Sit-up Test	Pull up Test	2 Hop Jump Test
9	-0.53**	-0.15	-0.136	0.383	-0.056	0.571**
10	-0.51**	-0.14	-0.054	0.425	-0.011	0.480**
11	0.251	0.301	0.411*	0.711	-0.018	0.382*
12	0.181	0.06	0.049	-0.242	-0.403*	0.299
13	-0.35	0.141	0.271	0.448	0.386*	0.110
14	-0.40*	-0.39*	-0.136	0.243	-0.044	0.481**
15	-0.56**	-0.54**	-0.482**	-0.088	0.218	0.709**
16	-0.61**	-0.321	-0.312	0.297	0.071	0.565**
17	-0.111	-0.011	-0.501**	-0.001	0.014	0.421*
18	-0.321	-0.401*	-0.413*	0.253	0.004	0.541**

** Correlation is significant at the 0.05 level*
*** Correlation is significant at the 0.01 level*

Table 1 illustrates the results of correlation tests between participants' height at different age levels and performance in AAHPERD test battery**.** The results showed a significant negative correlation between participants' height and performance in 45 m sprint test at five age levels including 9, 10, 14, 15 and 16. There was a significant negative correlation between participants' height and performance in 540 m run test at three age levels including 14, 15 and 18. A significant positive correlation was noticed between 11-year old participants' height and performance in 4×9 m Agility test while there was a significant negative correlation between participants' height and performance in 4×9 m Agility test at three age levels including 15, 17 and 18. The results showed a significant positive correlation between participants' height and performance in sit-up test at four age levels including 9, 10, 11 and 13. With regard to pull up test, the correlation was significant only at two age levels including a significant negative correlation in 12 year olds and a significant positive correlation in 13 year olds. The results revealed a significant positive correlation between participants' height and performance in 2 Hop Jump test at all age levels except for ages 12 and 13.

The results of the tests of correlation between participants' weight and performance in AAHPERD test battery

Table 2. The results of correlation tests between participants' weight and performance in AAHPERD test

Statistic Age	45 m sprint Test	540 m run Test	Agility Test	Sit-up Test	Pull up Test	2 Hop Jump Test
9	-0.501**	-0.087	-0.257	0.527*	0.032	0.508**
10	-0.365**	-0.198	-0.151	0.548*	0.033	0.628**
11	0.285	0.673**	0.119	0.628**	-0.201	0.017
12	-0.06	0.236	-0.154	-0.018	-0.225	0.214
13	-0.092	0.198	0.192	-0.556*	-0.414*	0.121
14	-0.442*	-0.379*	-0.188	0.261	-0.135	0.464*
15	-0.598**	-0.586**	-0.417*	-0.061	0.265	0.639**
16	-0.597**	-0.185	-0.022	0.376*	-0.075	0.461*
17	-0.361*	-0.254	-0.375*	0.111	0.181	0.401*
18	-0.409*	-0.389*	-0.352	0.389*	0.201	0.527**

** Correlation is significant at the 0.05 level*
*** Correlation is significant at the 0.01 level*

Table 2 illustrates the results of correlation tests between participants' weight at different age levels and performance in AAHPERD test battery**.** The results showed a significant negative correlation between participants' weight and performance in 45 m sprint test at all age levels except for 11, 12 and 13. There was a positive correlation between 11-year old participants' weight and performance in 540 m run test but a significant negative correlation in 14, 15 and 18 year olds. A significant negative correlation was noticed between participants' weight and performance in 4×9 m Agility test in 15 and 17 year olds. The results showed a significant positive correlation between participants' weight and performance in sit-up test at four age levels including 9, 10, 16 and 18 but a significant negative correlation in 11 and 13 year olds. There was a significant negative correlation between 13-year old participants' weight and performance in pull up test but the correlation at other age levels did not prove significant. The results revealed a significant positive correlation between participants' weight and performance in 2 Hop Jump test at all age levels except for 11, 12 and 13.

DISCUSSION

Investigation of the correlation between 9-18 year old boys' height and weight and performance in cardiorespiratory endurance test

With regard to the relationship between participants' height and performance in AAHPERD test battery, the results showed a significant negative correlation between participants' height and performance in cardiorespiratory endurance test in 14, 15 and 18 year olds. When the performance in a test is subject to time, negative correlation indicates improved performance. The significant correlation between height and performance in cardiorespiratory endurance test in 14, 15 and 18 year olds may be the result of puberty period. At the onset of puberty, muscular strength, lung capacity and cardiovascular efficiency increase considerably [6-7]. It seems that performance in 540 m run test, which examines the individual's cardiovascular endurance, depends more on physiological factors than height. Therefore, the present finding does not show a strong correlation between participants' height and performance in cardiorespiratory test. This is consistent with the findings of Cureton (1976), Hony Youlian (1998), Fleishman (1964), Vahidi (1990), Afarinesh (1991) and Danaie (1991).

Considering the relationship between participants' weight and performance in cardiorespiratory test, the results showed a significant negative correlation in 14, 15 and 18 year olds but a significant positive correlation in 11 year olds. In this case, negative correlation indicates improved performance and positive correlation addresses poor performance. This is consistent with the findings of Vahidi (1990), Afarinesh (1991) and Danaie (1991) but inconsistent with the findings of Cureton (1976) and Fleishman (1964) who reported positive correlation between weight and performance in 540 m run test. The inconsistency between the results of present and other studies in Iran and the studies conducted in foreign countries calls for a characterization of particular norms for Iranian students. Therefore, further studies may be required to address this issue. The correlation between weight and performance in cardiorespiratory test in 14, 15 and 18 year olds may relate to fact that, at the onset of puberty, increased muscle volume (increased weight with no increased fat) results in increased strength and cardiovascular efficiency due to secretion of sexual hormones. Therefore, increased cardiorespiratory endurance in these age levels may be more a direct function of increased efficiency of circulatory system than increased weight.

Investigation of the correlation between 9-18 year old boys' height and weight and performance in abdominal muscles endurance test

The results showed a significant positive correlation between height and performance in sit-up test in 9, 10, 11 and 13 year olds, but the correlation was not significant at other age levels. This is consistent with the findings of Vahidi (1990), Afarinesh (1991) and Danaie (1991) but inconsistent with the findings of Fleishman (1964).

Considering the relationship between weight and performance in abdominal muscles endurance test, the results showed a significant positive correlation in 9, 16, 17 and 18 year olds but a significant negative correlation in 11 and 13 year olds. Overall, from among the ten age levels, the correlation was positive at seven age levels and negative at three age levels though the correlation was not significant at any age level. This is consistent with the findings of Vahidi (1990), Afarinesh (1991), Danaie (1991) and Cureton (1976) but inconsistent with the findings of Fleishman (1964).

Investigation of the correlation between 9-18 year old boys' height and weight and performance in shoulder muscles endurance test

The results showed no significant correlation between participants' height and performance in shoulder muscles endurance test at all age levels except for 12 and 13 year olds. This is consistent with the findings of Fleishman (1964) and Afarinesh (1991) but inconsistent with the findings of Cureton (1976), Danaie (1991) and Vahidi (1990). The correlation was positive at five age levels including 13, 15, 16, 17 and 18 but negative at five age levels including 9, 10, 11, 12 and 14 though the correlations were not significant. Therefore, it seems that there is no relationship between participants' height and performance in shoulder muscles endurance test. However, it seems necessary to conduct further studies on this issue with larger sample size.

The results showed a significant negative correlation between weight and performance in pull up test in 13 year olds, but the correlation was not significant at other age levels. This is consistent with the findings of Danaie (1991) and Cureton and Kireilis (1976) but inconsistent with the findings of Fleishman (1964). The correlation was positive at five age levels including 9, 10, 15, 17 and 18 and negative at five age levels including 11, 12, 13, 14 and 16 though the correlations were not significant. Therefore, it seems that there is no relationship between participants' weight and performance in shoulder muscles endurance test. However, further studies may be required to fully illuminate this issue.

Investigation of the correlation between 9-18 year old boys' height and weight and performance in agility test

The results revealed a significant negative correlation between height and performance in 4×9 m Agility test in 15, 17 and 18 year olds but a significant positive correlation in the 11 year olds. Since the performance in the test depends on record time, negative correlation indicates improved performance with greater height, and positive correlation shows poor performance with greater height. This is consistent with the findings of Danaie (1991),

Fleishman (1964) and Afarinesh (1991) but inconsistent with the findings of Cureton (1976), Hajhadi (1980) and Vahidi (1990).

The results showed a significant negative correlation between weight and performance in 4/9 run test in 15 and 17 year olds, but the correlation was not significant at other age levels. The correlation was positive but insignificant in 11 and 13 year olds and negative but insignificant at other age levels. The negative correlation shows that, with increased weight, record time has decreased, resulting in better performance. This is consistent with the findings of Fleishman (1964) and Afarinesh (1991) but inconsistent with the findings of Cureton (1976), Danaie (1991), Hajhadi (1980) and Vahidi (1990).

Investigation of the correlation between 9-18 year old boys' height and weight and performance in 45 m sprint test

The results revealed a significant negative correlation between height and performance in 45 m sprint test in 9, 10, 14, 15 and 16 year olds whereas the correlation was negative but insignificant at other age levels. The negative correlation indicates that, with greater height, both performance in the sprint test and record time have increased. This is consistent with the findings of Saavedra (1991), Vahidi (1990) and Afarinesh (1991) but inconsistent with the findings of Cureton (1976) and Danaie (1991).

The results showed a significant negative correlation between weight and performance in 45 m sprint test at all age levels except for 11, 12 and 13 year olds. The negative correlation indicates that, with increased weight, record time has improved. This is consistent with the findings of Fleishman (1964) but inconsistent with the findings of Cureton (1976), Vahidi (1990), Danaie (1991) and Hajhadi (1990).

Investigation of the correlation between 9-18 year old boys' height and weight and performance in 2 Hop Jump test

The results showed a significant positive correlation between height and performance in 2 Hop Jump test at all age levels except for 12 and 13 year olds. The correlation was positive but insignificant in 12 and 13 year olds. This is consistent with the findings of Danaie (1991), Hajhadi (1980), Cureton (1976), Fleishman (1964), Afarinesh (1991) and Vahidi (1990).

The insignificance of correlation between height and performance in 2 Hop Jump in 12 and 13 year old boys may relate to their delayed onset of puberty comparing with the AAHPERD norm population (North Americans). Strength indicators do not typically follow linear progress in boys before puberty; however, at the onset of puberty, strength increases dramatically and does not radically change during the puberty period. Therefore, differences in the level of correlation between the ages 12 and 13 and other age levels may relate to delayed puberty. The results showed a significant positive correlation between weight and performance in 2 Hop Jump at all age levels except for 11, 12 and 13 year olds. The correlation between weight and performance in 2 Hop Jump in 11, 12 and 13 year olds was also positive but insignificant. Considering the positive correlation at all age levels, one may conclude that participants' weight exerts a positive effect on performance in 2 Hop Jump so that with greater weight, participants set better records. This is consistent with the findings of Danaie (1991), Hajhadi (1980), Vahidi (1990) and Afarinesh (1991) but inconsistent with the findings of Fleishman (1964).

Research has shown that there is direct association between increases in weight (without increases in body fat) and increased strength (power) (Namazi Zadeh, 1979; Ebrahim , 2002;)[6-14]. Therefore, with increased weight during the growth period, increases in strength also occur, which results in explosive power of leg muscles. However, Fleishman (1964) reported a significant negative correlation between weight and performance in 2 Hop Jump test. Despite this, the present study and several other studies in Iran showed a positive correlation between weight and performance in 2 Hop Jump test. This may be due to the fact that Iranian children height-weight charts at all age groups, including birth date to post-puberty period, show lower average comparing with American peers who represent the reference height-weight charts and AAHPERD norm of physical fitness. With increased age, this difference between Iranian boys and their American peers also increase. It may be reasoned that, with increased weight, Iranian boys approach the standard mean weight so that they may have better performance in 2 Hop Jump test. However, with increased weight in American reference population, the participants exceed the standard mean weight and reach the overweight limit, which results in their poor performance. The lack of significance between weight and performance in 2 Hop Jump test in 11, 12 and 13 year olds may account for this conclusion because the greatest difference in height-weight chart between Iranian and standard reference charts was noticed at these age levels.

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