

## SEROLOGICAL MARKERS In THE PROGNOSIS OF THE DEVELOPMENT OF HUMAN SPEED ABILITIES

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### Abstract

The article presents data on the study of a correlation between blood groups system AB0 and Rh with the peculiarities of the development of human speed abilities. It identifies a complex of genetic markers and substantiates the possibility of using this complex in the individual prognosis of the development of human motor abilities. The study shows that individuals with 0(I) and A(II) blood groups and Rh+ have a high predisposition to the development of speed abilities.

**Key words:** blood groups, Rhesus, genetic prognosis, speed abilities.

**Валентина Лишевська, Сергій Шаповал. Проблеми генетичної діагностики: серологічні маркери в прогнозі розвитку швидкісних здібностей людини.** У статті наведено матеріал про вивчення асоціативних зв'язків між групами крові системи АВ0 та Rh з особливостями розвитку швидкісних здібностей у чоловіків і жінок. Визначено комплекс генетичних маркерів, який можливо використовувати в індивідуальному прогнозі розвитку рухових здібностей людини. Серед них високу прогностичну цінність мають маркери 0(I), А(II) груп крові та позитивний резус-фактор.

**Ключові слова:** групи крові, резус фактор, генетичний прогноз, швидкісні здібності.

**Валентина Лишевская, Сергей Шаповал. Проблемы генетической диагностики: серологические маркеры в прогнозе развития скоростных способностей человека.** В статье приведен материал об изучении ассоциативной связи между группами крови системы АВ0 и Rh с особенностями развития скоростных способностей у мужчин и женщин. Выявлен комплекс генетических маркеров, которые можно использовать в индивидуальном прогнозе развития двигательных способностей человека. Среди них высокую предрасположенность к развитию скоростных способностей маркируют 0(I), А(II) группы крови и положительный резус-фактор.

**Ключевые слова:** группы крови, резус-фактор, генетический прогноз, скоростные способности.

**Introduction.** Diagnostics (psychological, medical, biological, etc.) is a sphere of knowledge designed to study the measuring methods and criteria of assessment, prediction of individual differences (psychological features, motor abilities, functional capabilities) in human development [2]. The term 'diagnosis' comes from the Greek word *diagnosis* and means «making out», «revealing» [1].

Sport and pedagogical diagnostics is a scientific area, which investigates individual or group differences according to their motor abilities or certain traits contributing to the formation of motor (sport) skills. The prognosis of motor abilities of children and young people is an important constituent of sport and pedagogical diagnostics. In this case, genetic markers can become informative criteria.

Such genetic markers as blood groups and systems, dermatoglyphics, specific features of the structure and color of the iris are informative markers in the genetic prognosis of human individual variability [5; 9]. Dermatoglyphics is the most studied among genetic markers. The rest of them have been studied fragmentarily. That is why we think it is timely to study blood groups and Rhesus factor systems as markers in the system of sport diagnostics.

**Research Aim and Tasks; Material and Methods.** Recent findings of professor Serhiyenko and his colleagues are concerned with the distribution of blood groups in elite sportsmen engaged in academic rowing, canoe rowing, bullet shooting [2; 5]. They identified the differences in phenotypic manifestation of blood groups in sportsmen of different specialization and performance level.

A relationship between individual motor abilities and blood groups of the AB0 system was examined [4]. Two hundred 17–19-year old female students (every 50 people with a different blood group) took part in a complex investigation of coordination, strength, speed, endurance and joints flexibility. In a more numerous sample of students (999 people, 490 men and 509 women), an association between the development of individual endurance and blood groups together with the rhesus factor system was studied [7, 8]. Later [10],

in a sample of high school students aged 15–17 years (822 individuals), the research identified serological markers (the ABO and rhesus factor systems) of the development of peculiarities of strength and anaerobic abilities. However, there are insufficient studies of similar kind.

The present study has been undertaken to determine serological markers of the specific features of human speed abilities development.

The study was designed:

To find associations between blood groups and speed abilities in young men and women.

To establish a relationship between human speed abilities and the serological rhesus-factor (Rh) system.

To investigate gender peculiarities of the phenotypes of serological markers of blood groups of the ABO system and the Rh system.

*Research method.* Senior high school students were asked to perform the following running tests: a 60-meter sprint for 15-year old boys and girls, and a 100-meter sprint for male and female teenagers (16–17 years). The running began at standing start; the time was recorded to the nearest tenth of a second. The subjects had two trials. The best score was recorded as the test result. In order to create a competitive environment, at least two subjects took part in a race.

The study involved 822 high school students aged 15–17. The classification of subjects according to sex, age and blood group is shown in table 1.

Table 1

**The Distribution of Subjects (High School Students) According to Sex, Age and Blood Group**

Age, Years	Blood Group				Total
	0(I)	A(II)	B(III)	AB(IV)	
<i>Males</i>					
15	24	21	26	22	93
16	49	45	34	31	159
17	31	29	27	24	111
Total	104	95	87	77	363
<i>Females</i>					
15	18	23	22	19	82
16	47	38	51	34	170
17	55	65	48	39	207
Total	120	126	121	92	459
Total Number	224	221	208	169	822

**Research Results and Discussion.** The results of the 60m and 100m run for 15–17-year old males and females are listed in Tables 2 and 3. A tendency to lower results of speed tests in males and females at different age is presented in Table 4. As we see, the trend in the phenotypic display of speed abilities in girls and young men is in many ways similar. Subjects with 0(I) и A(II) blood types have the best results; those with AB(IV) and B(III) groups reveal the worst ones. In absolute values of speed abilities, male subjects of all age groups and different blood types were superior to females.

Table 2

**Results of the 60 m and 100 m Run Tests for 15–17-Year Old Males Having Different Blood Groups, s**

Blood Groups	Statistical Indices	Age, Years		
		15	16	17
0(I)	$\bar{X}$	9,20	14,79	14,47
	$\pm S$	0,64	0,44	0,49
	$\pm m$	0,13	0,06	0,08
A(II)	$\bar{X}$	9,53	14,80	14,94
	$\pm S$	0,57	0,44	0,49
	$\pm m$	0,12	0,06	0,09
B(III)	$\bar{X}$	9,63	15,63	15,09
	$\pm S$	0,62	0,40	0,46
	$\pm m$	0,12	0,06	0,09
AB(IV)	$\bar{X}$	9,77	15,25	15,36
	$\pm S$	0,56	0,40	0,59
	$\pm m$	0,12	0,07	0,12

Table 3

**Results of the 60 m and 100 m Run Tests for 15–17-Year Old Girls Having Different Blood Groups, s**

Blood Groups	Statistical Indices	Age, Years		
		15	16	17
0(I)	$\bar{X}$	9,89	16,85	16,31
	$\pm S$	0,43	0,29	0,56
	$\pm m$	0,10	0,04	0,07
A(II)	$\bar{X}$	9,90	17,11	16,62
	$\pm S$	0,39	0,39	0,47
	$\pm m$	0,08	0,06	0,05
B(III)	$\bar{X}$	10,14	17,14	16,94
	$\pm S$	0,36	0,46	0,50
	$\pm m$	0,07	0,06	0,07
AB(IV)	$\bar{X}$	10,03	17,18	17,04
	$\pm S$	0,44	0,41	0,45
	$\pm m$	0,10	0,07	0,07

Table 4

**Tendency to Lower Results of Speed Tests in Teenage Boys and Girls Having Different Blood Groups**

Sex	Age, Years	Tendency
Teenage Boys	15	0(I) > A(II) > B(III) > AB(IV)
	16	0(I) = A(II) > AB(IV) > B(III)
	17	0(I) > A(II) > B(III) > AB(IV)
Teenage Girls	15	0(I) = A(II) > AB(IV) > B(III)
	16	0(I) > A(II) > B(III) > AB(IV)
	17	0(I) > A(II) > B(III) > AB(IV)

Physical manifestation of speed abilities in Rh+ and Rh- males in the running test on the 60-meter and 100-meter course is given in Tables 5 and 6 correspondingly. The comparison of the corresponding values in Rh+ and Rh- teenage boys shows that they are higher in Rh+ subjects. Though the differences in the mean values are insignificant ( $p > 0,05$ ),  $t$  values are still more significant in 16-year old teenage boys (see table 5 and table 7). In the subjects with 0(I) and A(II) blood groups compared with young men having AB(IV) and B(III) blood groups, a tendency toward higher results in speed tests remains the same in all ages both for Rh+ and Rh-subjects.

Table 5

**Results of the 60 m Run Test for 15–17-Year Old Boys Having Different Blood groups and Rh Factor, s**

Blood Groups	Statistical Indices	Rhesus-Factor		t	p
		Rh+	rh-		
0(I)	$\bar{X}$	9,12	9,30	0,668	> 0,05
	$\pm S$	0,61	0,69		
	$\pm m$	0,17	0,20		
A(II)	$\bar{X}$	9,40	9,70	1,201	> 0,05
	$\pm S$	0,56	0,56		
	$\pm m$	0,16	0,18		
B(III)	$\bar{X}$	9,80	9,51	1,211	> 0,05
	$\pm S$	0,56	0,65		
	$\pm m$	0,16	0,17		
AB(IV)	$\bar{X}$	9,73	9,83	0,405	> 0,05
	$\pm S$	0,59	0,55		
	$\pm m$	0,16	0,18		

Table 6

**Results of the Running Test on a 100-Meter Course in 16–17-Year Old Boys With Different Blood Groups and Rh Factor, s**

Blood Group	Statistical Indices	Rh+		rh–	
		16 Years	17 Years	16 Years	17 Years
O(I)	$\bar{X}$	14,70	14,40	14,90	14,60
	$\pm S$	0,45	0,47	0,40	0,53
	$\pm m$	0,08	0,10	0,08	0,16
A(II)	$\bar{X}$	14,67	14,80	14,92	15,10
	$\pm S$	0,45	0,55	0,41	0,39
	$\pm m$	0,09	0,14	0,08	0,10
B(III)	$\bar{X}$	14,81	15,00	15,03	15,21
	$\pm S$	0,42	0,43	0,34	0,50
	$\pm m$	0,10	0,11	0,08	0,15
AB(IV)	$\bar{X}$	15,20	15,32	15,30	15,40
	$\pm S$	0,38	0,60	0,44	0,60
	$\pm m$	0,09	0,16	0,12	0,18

Table 7

**Statistical Differences in the Results of the Running Test on a 100-Meter Course in 16–17-Year Old Boys with Different Rh Factor, s**

Age, Years	Statistical Indices	Blood Groups			
		O(I)	A(II)	B(III)	AB(IV)
16	t	1,621	1,929	1,654	0,660
	p	> 0,05	> 0,05	> 0,05	> 0,05
17	t	1,033	1,689	1,211	0,323
	p	> 0,05	> 0,05	> 0,05	> 0,05

The phenotypic display of speed abilities in girls with Rh+ and Rh– in the 60m and 100 m sprints is presented in tables 8 and 9. The tendency to differential distinctions in speed abilities in the girls is in most ways similar to the tendency reported in teenage boys. The girls with Rh+ showed a higher level of speed ability development than Rh– subjects. On the 60-meter course, 15-year old girls having B(III) blood group showed significant differences ( $p < 0,05$ ); on the 100-meter course significant differences were reported in blood groups A(II), B(III) and AB(IV) in 16–year old females, and in blood groups A(II) и B(III) in girls aged 17.

Table 8

**Results of the 60 m Sprint Test in 15-Year Old Girls Having Different Blood Groups and Rh Factor, s**

Blood Groups	Statistical Indices	Rhesus-Factor		t	p
		Rh+	rh–		
O(I)	$\bar{X}$	9,81	10,00	0,926	> 0,05
	$\pm S$	0,44	0,42		
	$\pm m$	0,14	0,15		
A(II)	$\bar{X}$	9,92	9,89	0,186	> 0,05
	$\pm S$	0,39	0,40		
	$\pm m$	0,11	0,12		
B(III)	$\bar{X}$	10,01	10,30	<b>2,004</b>	<b>&lt; 0,05</b>
	$\pm S$	0,33	0,34		
	$\pm m$	0,09	0,10		
AB(IV)	$\bar{X}$	9,90	10,20	1,473	> 0,05
	$\pm S$	0,42	0,45		
	$\pm m$	0,12	0,15		

Table 9

**Results of the Running Test on a 100-Meter Course for 16–17-Year Old Girls Having Different Blood Groups and Rh Factor, s**

Blood groups	Statistical indices	Rh+		rh–	
		16 Years	17 Years	16 Years	17 Years
0(I)	$\bar{X}$	16,80	16,25	16,90	16,40
	$\pm S$	0,27	0,55	0,30	0,48
	$\pm m$	0,05	0,09	0,06	0,12
A(II)	$\bar{X}$	17,00	16,50	17,25	16,77
	$\pm S$	0,37	0,46	0,38	0,44
	$\pm m$	0,08	0,07	0,09	0,08
B(III)	$\bar{X}$	17,01	16,82	17,30	17,08
	$\pm S$	0,41	0,53	0,47	0,45
	$\pm m$	0,08	0,10	0,09	0,09
AB(IV)	$\bar{X}$	17,00	17,00	17,41	17,11
	$\pm S$	0,30	0,42	0,41	0,51
	$\pm m$	0,07	0,08	0,10	0,13

The comparison of differential distinctions of Rh+ and Rh- boys and girls shows that the girls display more significant differences in speed tests results. As to the population as a whole, the most significant differences in the development of speed abilities are observed in the carriers of A(II) and B(III) blood groups. The age of 16 is the age of the most significant differences.

Table 10

**Statistical Differences in the Results of the 100 m Running-Based Test in 16–17-Year Old Girls with Different Rh Factor, s**

Age, Years	Statistical Indices	Blood Groups			
		0(I)	A(II)	B(III)	AB(IV)
16	t	1,169	<b>2,022</b>	<b>2,337</b>	<b>3,181</b>
	p	> 0,05	< <b>0,05</b>	< <b>0,05</b>	< <b>0,01</b>
17	t	0,944	<b>2,381</b>	<b>2,004</b>	0,691
	p	> 0,05	< <b>0,05</b>	< <b>0,05</b>	> 0,05

In many respects, the data obtained in this study are consistent with the results of our earlier work [10]. The investigation of serological markers of strength (tests: pulling oneself up on a horizontal bar and push-ups) and anaerobic abilities (tests: sit-ups during 30 s) in one and the same sample group of high school students determined a tendency toward a better phenotypic manifestation of dynamic muscle strength and anaerobic lactate power ability in individuals with 0(I) and A(II) blood groups compared with people having B(III) and AB(IV) blood groups and Rh+. This apparently can be explained by the fact that a number of publications report on a positive correlation between strength and speed abilities. High test results in assessing the development of anaerobic abilities also largely depend on the development of speed abilities.

The regularities described can be used in individual genetic prognosis and sport selection. The assumption that differential distinctions in the manifestation of speed abilities are formed in childhood suggests that children having the 0(I) blood group and Rh+ are more promising for physical activity (or sports) where speed abilities are essential for achieving high performance. Less promising in this case may be children with the AB(IV) blood group.

**Conclusions.** The study determines associative links between blood groups of the ABO and Rh systems and the level of human speed abilities development.

It shows that blood groups and the Rh system can be genetic markers of a high predisposition to the development of speed abilities in men and women.

The study identifies a tendency to better phenotypic manifestation of speed abilities in individuals with 0(I) и A(II) blood groups compared with people having AB(IV) and B(III) blood groups. The regularity in a decrease in the predisposition to the development of human speed abilities is as follows: 0(I) > A(II) > B(III) > AB(IV).

Compared with Rh–, the positive Rhesus factor is a genetic marker that allows predicting a higher predisposition to the development of human speed abilities.

The complex of genetic markers of the blood system AB0 and Rh does not have gender differences.

The study provides practical recommendations as to the use of the regularities identified in the system of sport selection.

**Prospects for Further Research.** Further research may be aimed at determining serological markers of some specific features of the development of coordination abilities and heritability of human joints flexibility.

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