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# Pathogenic Role of the Age and Height in the Development of Low Blood Pressure in Young Women

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**Abstract**

The role of the age, height, and weight in the development of low blood pressure (LBP) in young women was estimated. A regression analysis between the dependent variables – systolic blood pressure (SBP), diastolic blood pressure (DBP) and independent variables – age, height, and weight in 1,264 women with a median age of 18 yrs was performed. Finally, 18% of women aged 18-35 yrs have LBP (SBP 100 mm Hg and below and/or DBP 60 mm Hg and less). Age and height of young women are significant factors in the development of LBP (with SBP of 94 mm Hg or less, and/or DBP of 65 mm Hg and less).

## Keywords

Low blood pressure; Young women; Height; Weight; Age

## Introduction

Blood pressure is an indicator of human health. Low blood pressure (LBP) with the level of systolic blood pressure (SBP) of 60-70 mm Hg today is seen as one part of J-curve at higher risk of cardiovascular complications [1,2]. The prevalence of LBP in different age and gender groups ranges from 7.2% (as measured in the afternoon) to 56% (during sleep with daily monitoring) [3,4]. Forecast of the LBP has not been studied, so that in most countries doctors do not consider LBP as pathology or disease. And despite the fact, that almost 70% of young women with LBP complain of health disorders [5,6]. The role of constitutional (height, weight) and demographic (race, age) of the parameters is known in the formation of arterial hypertension [1]. But in the pathogenesis of LBP the role of age, weight, and height remains poorly understood [7,8]. Weight reduction in hypertension has shown its effectiveness and is recommended for all patients with increased body mass index [1]. The possibility of correcting LBP through the control of body weight as a variability parameter, unlike height, gender, and age is interesting. The aim of the study is to estimate the role of the age, height, and weight in the formation of arterial hypotension in young women.

## Methods

An object of the study is arterial hypotension. Subject of the study are the age and anthropometric indices in arterial hypotension in young women: Single-step type of the study. Study was conducted during the examination of Perm University students before admission to sport activities. Location of the examination – medical clinic. Time of examination – from 15 to 19 h. Inclusion criteria were female gender, age from 18 to 35 yrs. Exclusion criteria were acute respiratory viral infection, pregnancy. Study protocol consistent with the Declaration of Helsinki (1975) and its revised version (1983). Design, study protocol, and informed consent to participate in the study were approved by the Ethics Committee of Medical University PGMA named by E. A. Vagner. Standard blood pressure measurement at the shoulder was made by certified doctors by a tonometer A & D UA-777 (A & D Electronic, Japan). The measurement was conducted in a sitting position, twice at an interval of 3 min. Arithmetic mean of the two measurements was calculated and analyzed. Height and weight were measured by standard methods. In accordance with data from Maasova and Baev, SBP of 100 mm Hg and below is considered as low [5,9]. In accordance with the criteria of Mancia G. DBP evaluated as low if it is 60 mm Hg and below [10]. Statistical analysis was performed by a multiple regression. When building a multiple regression model, the effect of intercorrelation between the independent variables (if the correlation coefficient between a pair of independent variables is equal to or greater than 0.6, then one of the variables was excluded from the model) was included [11]. Dependence of SBP and DBP from age, height, and weight was evaluated. Dependent variables were SBP and DBP, independent variables – age, height, and weight. Tightness of correlation link was determined by coefficient $R^2$, its description was carried out on a Cheddok scale. Multiple regression model included a free member and the regression coefficient (b) for each independent variable. Reliability of the results was evaluated if $p < 0.05$. Statistical analysis was made by the program Statistica 6.1. (Stat Soft, USA; № AXXR912E53722FA).

## Results and Discussion

The study involved 1,264 women with a median age of 19 yrs (25th percentile – 18; 75th percentile – 20 yrs). Subgroups with different levels of SBP and DBP were formed. For SBP levels were chosen: 120 mm Hg and less (76% of the patients); 110 mm Hg and less (47%); 100 mm Hg and less (19%); 98 mm Hg and less (6%); 96 mm Hg and less (5%); 94 mm Hg and less (5%); 90 mm Hg and less (4%). For DBP levels were chosen: 80 mm Hg and less (86% of the patients); 70 mm Hg and less (53%); 65 mm Hg and less (27%); 60 mm Hg and less (18%); 55 mm Hg and less (2%); and 50 mm Hg and less (1%). Before

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| SPB, level mm Hg | *n* | *p* | Free member | $r^2$ | Age (yrs) | Height (cm) |
|---|---|---|---|---|---|---|
| | | | | | *B* | |
| Total | 1264 | 0.53 | 105.3 | 0.11 | −0.15 | 0.02 |
| 120 and less | 962 | 0.48 | 91.8 | 0.05 | −0.16 | 0.13 |
| 110 and less | 589 | 0.26 | 92.7 | 0.09 | −0.22 | 0.20 |
| 100 and less | 238 | 0.33 | 81.1 | 0.06 | −0.13 | 0.16 |
| 98 and less | 79 | 0.19 | 65.2 | 0.21 | −0.14 | 0.44 |
| 96 and less | 68 | 0.16 | 69.8 | 0.24 | −0.10 | 0.47 |
| 94 and less | 62 | 0.00 | 87 | *0.33* | *−0.35* | *0.34* |
| 90 and less | 48 | 0.00 | 87 | *0.33* | *−0.35* | *0.34* |

Note: Significant β are marked italics.

**Table 1:** Multiple regression analysis of the influence of age and height on SBP at different levels of SBP

| Indicator | 25% | Median | 75% |
|---|---|---|---|
| SAP (mm Hg) | 90 | 90 | 90 |
| DAP (mm Hg) | 58 | 60 | 60 |
| Age (yrs) | 18 | 19 | 20 |
| Height (cm) | 158 | 162 | 168 |
| Weight (kg) | 49 | 50 | 55 |

**Table 2:** Characteristic of subgroup with SAP of 94 mm Hg and less

| DBP, level mm Hg | *n* | *p* | Free member | $r^2$ | Age (yrs) | Height (cm) |
|---|---|---|---|---|---|---|
| | | | | | *B* | |
| Total | 1264 | 0.65 | 119 | 0.05 | −0.11 | −0.22 |
| 80 and less | 1092 | 0.34 | 128 | 0.03 | −0.09 | *−0.37* |
| 70 and less | 665 | 0.42 | 115 | 0.10 | −0.16 | *−0.44* |
| 65 and less | 338 | 0.00 | 60 | 0.10 | *−0.19* | −0.15 |
| 60 and less | 231 | 0.00 | 60 | 0.10 | *−0.22* | 0.11 |
| 55 and less | 31 | 0.63 | 32 | 0.29 | −0.31 | 0.42 |
| 50 and less | 16 | 0.16 | 91 | 0.34 | 0.33 | −0.57 |

Note: Significant β are marked italics.

**Table 3:** Multiple regression analysis of the influence of the age and height on DBP at different levels of DBP

| Indicator | 25% | Median | 75% |
|---|---|---|---|
| SAP (mm Hg) | 96 | 100 | 100 |
| DBP (mm Hg) | 59 | 60 | 60 |
| Age (yrs) | 18 | 19 | 20 |
| Height (cm) | 158 | 163 | 168 |
| Weight (kg) | 49 | 54 | 58 |

**Table 4:** Characteristic of subgroup with DBP of 60 mm Hg and less

performing regression analysis, independent variables were tested for cross-correlations. In the total group, there was a linear correlation of moderate intensity between weight and height ($r = 0.41$ with $p < 0.05$), there was no correlation between age and growth ($r = 0.11$ with $p > 0.05$). With the cross-correlation, a multiple regression model was constructed using only two factors: growth and age.

Table 1 shows that the regression model of the dependence of the SBP on the age and height was moderate in two subgroups: 94 mm Hg and less; 90 mm Hg and less. In the two-component model of oscillations of SBP from 94 mm Hg and less the main role is the height (positive effect) and age (negative effect). In a cohort of young women with SBP of 94 mm Hg and less every year reduces free member (87 mm Hg) to 0.35 mm Hg, and each centimeter of the height increases free member by 0.34 mm Hg.

Thus, the regression model allows to predict the value of individual SBP in cohort of girls with SBP level of 94 mm Hg and less, taking into account their characteristics (Table 2): (a) in a girl of 18 yrs with a height above 168 cm SBP will most likely be 94 mm Hg; (b) in a girl over 20 yrs old and shorter than 158 cm SBP will most likely be less than 90 mm Hg.

Table 3 shows that the regression model of the dependence of the DBP on the age and height was weak in subgroups with LBP: 65 mm Hg and less; 60 mm Hg and less. In the two-component model of DBP oscillation from 60 mm Hg and less a value has just only age (negative impact), but not height. In a cohort of young women with DBP of 60 mm Hg and less, every year reduces free member (60 mm Hg) to 0.22 mm Hg, and each centimeter of the height increases free member by 0.11 mm Hg.

Thus, the regression model allows to predict the individual value of DBP in a cohort of women with DBP level of 60 mm Hg. and less, taking into account their characteristics (Table 4):

(a) DBP in a girl of 18 yrs will be the most likely of 60 mm Hg;

(b) DBP in a girl of 20 yrs will be the most likely of 58 mm Hg and less.

Young women have certain stereotypes of social and feeding behavior. In this case, weight loss for is the most important goal in life. However, studies show that just young age, high height, low weight, and female gender is associated with a large number of insignificant and significant for health complaints [12-16]. With LBP such complaints as fatigue, poor exercise tolerance, dizziness, fainting, and cognitive disorders such as mood instability, poor performance, decreased memory and attention could be significant arguments of the physician in selecting methods of care for the patients. Doctors in English-speaking countries refrain from interfering because of possible adverse side effects of drugs, ignoring the benefits of treatment for these patients [17]. And only in Germany, physicians actively treated patients with SBP, seeking to alleviate their suffering [18,19]. In most cases, a special diet with a high content of salt, the increased volume of fluid intake, tonics, and stimulants (including the use of activators of cerebral monoamines) are used [20].

## Conclusion

Overall, 18% of women aged 18-35 yrs have LBP (SBP 100 mm Hg and below and/or DBP of 60 mm Hg and less). Age and height of young women are significant factors in the formation of LBP. Age has a negative impact on low SBP and DBP, height – a positive effect on SBP.

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