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Letter to the Editor

Association between Height and Peripheral Blood Cell Count in Korean Adults

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Dear Editor-in-Chief

There is solid evidence regarding increased risk of cardiovascular disease (CVD) in short people (1), but a reasonable explanation is warranted. Interestingly, a Japanese research group clarified this issue using hematological markers. Because short people have less bone marrow, a lower hematopoietic capacity was observed in the shorter elderly population (2). Another study also supported their speculation that height positively correlates with circulating endothelial progenitor cells (CD34+ cells) (3). However, the association between CD34+ cell and CVD events might be reciprocal. CD34+ cell production in the bone marrow is induced by certain endothelial injuries, which are more likely to occur in short people (1).

Peripheral blood cells are inarguably related to hematopoietic stem cells. Furthermore, leukocytes or platelets are link to atherosclerosis with endothelial repair (4), independent of other CVD risk factors. Thus, it is expected that short people would have high peripheral blood cell count, which results from the increased CD34+ cell production in the bone marrow. To our knowledge, only one study has examined the direct association between height and leukocytes in a hospital-based setting (5).

From data of the 2007−2012 Korea National Health and Nutrition Examination Survey, we identified 11,634 adults aged above 50 yr with available data on complete blood count. After excluding patients with a history of cancer or CVDs, 10,193 subjects were included in the final analysis. Complete blood count including leukocytes, erythrocytes, and platelets, was measured using an XE-2100D hematology analyzer (Sysmex, Kobe, Japan). We used the serum ferritin level, which reflects iron storage and inflammation, as a confounder. We also obtained information on demographics, health-related habits, and comorbid conditions. All analyses were performed using STATA SE 9.2 (Stata Corp., College Station, TX). All statistical tests were two-sided, and statistical significance was defined as a *P* value of less than 0.05.

Table 1 shows β and 95% confidence interval values of each blood cell per 1-cm increment in height, with adjustment for potential confounders. Height was negatively associated with leukocyte and platelet counts in both sexes (not significant in red blood cell; data not shown), and the

association was more prominent in females. Sensitivity analysis, stratified by type 2 diabetes, revealed that the reverse association was significant only in individuals without type 2 diabetes.

Table 1: Association between height (per 1-cm increment) and complete blood count in overall and type 2 diabetes-stratified subgroups

Count	*Males* β^a	*95% CI*	*P-value*	*Females* β^a	*95% CI*	*P-value*
Overall	(N=4,092)			(N=5,612)		
White blood cell, $\times 10^3/\mu L$	-0.021	-0.031, -0.012	<0.001	-0.025	-0.034, -0.016	<0.001
Platelet, $\times 10^3/\mu L$	-0.922	-1.245, -0.598	<0.001	-1.020	-1.376, -0.665	<0.001
With type 2 diabetes	(n=758)			(n=798)		
White blood cell, $\times 10^3/\mu L$	-0.003	-0.027, 0.020	0.772	-0.045	-0.078, -0.011	0.010
Platelet, $\times 10^3/\mu L$	-0.669	-1.535, 0.197	0.130	-0.331	-1.568, 0.904	0.598
Without type 2 diabetes	(n=3,334)			(n=4,814)		
White blood cell, $\times 10^3/\mu L$	-0.024	-0.035, -0.014	<0.001	-0.023	-0.033, -0.014	<0.001
Platelet, $\times 10^3/\mu L$	-0.973	-1.320, -0.626	<0.001	-1.115	-1.483, -0.747	<0.001

[a] Regression coefficient from multivariate regression models with adjustment for age, economic status, obesity, smoking status, drinking habit, hypertension, diabetes, and serum ferritin levels. CI, confidence interval

In the present Korean nationwide study, we found that shorter people have higher leukocyte and platelet counts and these associations remain significant among non-diabetic individuals. A reverse association between leukocytes/platelets and height is expected, considering their contribution to the development of atherosclerotic lesions (4), which are correlated with short height. Comparable to the findings of our study, a previous Japanese cross-sectional study (5) reported that height was inversely associated with leukocyte count in adults. However, the study limited the participants to middle-aged males referred for a general health check-up in a hospital. In our study, beside the representativeness, several potential confounders, including economic status, lifestyle habits, and serum ferritin levels, were rigorously considered.

Type 2 diabetes is a well-known endothelial impairment factor; therefore, the need for endothelial repair in diabetic patients is much higher than that in non-diabetic individuals (6). Therefore, strong signals for stabilizing endothelial patency—with a consumptive reduction in circulating CD34+ cells—are continuously sent to the bone marrow, and conclusively, there is an increased number of activated platelets or leukocytes in the peripheral blood of diabetic patients (7). Under such conditions, the influence of height on blood cell counts might be attenuated. In the same vein, the weak association in females could also be explained by the lower atherosclerotic risk in females than in males.

The snapshot feature did not allow us to examine the longitudinal or sequential inter-relation between height and blood cell counts. Hematopoietic interplay (e.g., CD34+ cells) between the bone marrow and peripheral blood should be investigated in the concurrent population. Despite the limitation, this is the first study to report an inverse association between adult height and peripheral blood cell counts in a representative Korean sample. In the future, well-designed longitudinal studies (e.g., a Mendelian randomization study) are warranted to confirm our findings.

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Conflict of interest

The authors declare that there is no conflict of interest.

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