

## Serum hemoglobin levels are independently associated with the prevalence of carotid plaque

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**Background:** Despite the impact of low hemoglobin (Hb) on adverse clinical outcomes, data on the association between Hb level and subclinical atherosclerosis are limited. Carotid plaque is known as a useful predictor of new-onset cardiovascular (CV) disease irrespective of CV risk status. **Method:** This study evaluated the beneficial range of Hb for the risk of carotid plaque compared to low Hb in asymptomatic individuals without a history of major adverse clinical events. **Results:** Overall, 2,560 (age, 60 ± 8 years; 33% men) participants were stratified into four groups based on the Hb level ≤129 g/L (group I), 130–139 g/L (group II), 140–149 g/L (group III), and ≥150 g/L (group IV). Hb level ≤129 g/L was defined as low Hb level. Carotid plaque was observed in 856 (33.4%) participants; its prevalence was 33.8%, 29.0%, 36.1%, and 38.5% in groups I, II, III, and IV, respectively. Compared to group I, the prevalence of carotid plaque was significantly lower only in group II. In univariate regression analysis, the risk of carotid plaque was lower only in group II (odds ratio [OR] 0.800; 95% confidence interval [CI] 0.646–0.990; *p*=0.040) compared to that in group I. After adjusting for age, sex, hypertension, diabetes, dyslipidemia, obesity, smoking, and serum creatinine level, group II (OR 0.791; 95% CI 0.629–0.994; *p*=0.044) had lower risk of carotid plaque compared to group I. **Conclusion:** Serum Hb level had an independent relationship with the prevalence of carotid plaque in a relatively healthy general population. **Keywords:** hemoglobin; carotid plaque; subclinical atherosclerosis

Table 1. Baseline characteristics

	Total (n = 2560)	Categorical Hb groups				P value
		I (lowest) (≤ 129 g/L) (n = 720)	II (130–139 g/L) (n = 860)	III (140–149 g/L) (n = 546)	IV (highest) (≥ 150 g/L) (n = 434)	
Age, years	60.4 ± 7.9	60.8 ± 7.8	60.4 ± 7.3	60.7 ± 8.0	59.8 ± 8.9	0.045
Male sex, n (%)	842 (32.9)	65 (9.0)	125 (14.5)	237 (47.1)	395 (91.0)	< 0.001
BMI, kg/m <sup>2</sup>	24.9 ± 3.0	24.3 ± 3.0	24.8 ± 3.0	25.0 ± 2.9	25.6 ± 2.9	< 0.001
SBP, mmHg	122.0 ± 15.1	119.4 ± 15.4	121.0 ± 14.0	124.8 ± 14.1	127.7 ± 15.1	< 0.001
DBP, mmHg	73.9 ± 9.8	70.5 ± 9.7	72.7 ± 9.3	76.0 ± 8.8	79.3 ± 9.5	< 0.001
Hypertension, n (%)	1273 (49.7)	238 (46.9)	403 (46.9)	284 (53.8)	238 (54.8)	0.004
Diabetes mellitus, n (%)	411 (16.1)	109 (15.1)	108 (12.6)	155 (29.2)	89 (20.5)	< 0.001
Dyslipidemia, n (%)	1829 (71.8)	496 (68.9)	605 (70.5)	412 (75.0)	328 (75.1)	0.020
Obesity, n (%)	1158 (45.2)	281 (39.0)	380 (42.2)	253 (46.3)	244 (56.2)	< 0.001
Smoking, n (%)	695 (27.1)	59 (8.2)	125 (14.5)	210 (38.5)	301 (69.4)	< 0.001
Total cholesterol, mmol/L	5.16 ± 0.94	5.13 ± 0.94	5.22 ± 0.96	5.12 ± 0.92	5.15 ± 0.92	0.168
Triglycerides, mmol/L	1.46 ± 0.80	1.32 ± 0.69	1.39 ± 0.72	1.52 ± 0.85	1.74 ± 0.95	< 0.001
HDL-C, mmol/L	1.41 ± 0.38	1.50 ± 0.39	1.44 ± 0.38	1.36 ± 0.37	1.25 ± 0.35	< 0.001
LDL-C, mmol/L	3.15 ± 0.85	3.10 ± 0.85	3.19 ± 0.87	3.12 ± 0.84	3.18 ± 0.85	0.123
Hb, g/L	137 ± 13	123 ± 6	134 ± 3	144 ± 3	157 ± 6	< 0.001
Fasting glucose, mmol/L	5.82 ± 1.14	5.41 ± 0.89	5.49 ± 0.95	5.81 ± 1.29	6.02 ± 1.50	< 0.001
Creatinine, μmol/L	70.72 ± 17.68	61.88 ± 17.68	61.88 ± 17.68	70.72 ± 17.68	79.56 ± 17.68	< 0.001

Values are presented as mean ± standard deviation or number (%).

BMI, body mass index; DBP, diastolic blood pressure; Hb, hemoglobin; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; SBP, systolic blood pressure.

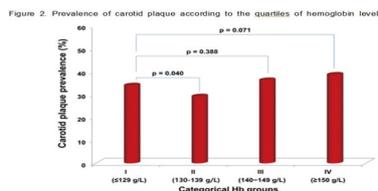


Figure 3. Impact of hemoglobin level on the risk of carotid plaque after adjusting for (A) age and sex and (B) age, sex, hypertension, diabetes, dyslipidemia, obesity, smoking, and serum creatinine level

