Circulating glycerophosphatidylcholines (GPCs) and their second messenger metabolites (smGPCs), including lysophosphatidylcholines and platelet-activating factors, are phospholipids that modulate atherosclerosis and inflammation and thus risk for cardiovascular disease (CVD). CVD is a slow-progressing disease culminating by acute vascular events or chronic vascular conditions in middle-to-late adulthood, but its initial pre-clinical stages may already occur during adolescence. Here, we investigated whether circulating smGPCs are associated with main CVD risk factors – excess visceral fat, elevated blood pressure, insulin resistance, and low-grade inflammation – during adolescence. We studied a population-based sample of 1,029 adolescents (12-18 years, 48% male), as part of the Saguenay Youth Study. We used targeted serum lipidomics (LC-ESI-MS) to identify and quantify circulating smGPCs within the 440-640 Da range. In all participants, we also assessed: (i) visceral fat measured with MRI and total body fat measured with bioimpedance; (ii) blood pressure under standard clinical conditions; and (iii and iv) fasting serum insulin (as an index of insulin resistance) and C-reactive protein (as an index of low-grade inflammation). We identified a total of 81 smGPCs that varied by the length and saturation of fatty acid residues, and the type of linkage these residues are attached to the glycerol backbone. Several of them were associated with multiple CVD-risk factors (p<1.5x10^-4, after Bonferroni correction for 324 comparisons); the most significant of these were PC(16:0/2:0) and LPC(14:1/0:0). PC(16:0/2:0) was associated inversely with visceral fat (p=2.4x10^{-18}), blood pressure (p=3.2x10^{-5}) and C-reactive protein (p=1.2x10^{-30}), and LPC(14:1/0:0) was associated positively with visceral fat (p=8.3.x 10^{-8}) and fasting insulin (p=1.7x10^{-24}). Sobel’s test of mediation revealed that PC(16:0/2:0) mediated the directed relationships between VF (as a causal factor) and blood pressure or C-reactive protein (as an outcome, p=4.3x10^{-4} and p=5.0x10^{-10}, respectively), and LPC(14:1/0:0) mediated the directed relationships between VF (as a causal factor) and fasting insulin (as an outcome, p=3.5x10^{-4}). Thus, specific circulating smGPCs are strongly associated with multiple CVD risk factors in adolescence; some of these associations appear to be ‘protective’ whereas others ‘adverse’. These smGPCs may serve as novel biomarkers of early CVD development. Elucidating pathways regulating their circulating levels may provide new pharmaceutical targets of CVD.