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adenosine monophosphate-activated protein kinase and consequently aggravate the phenotype of the disease [1]. Some of the other metabolic abnormalities detected in our analysis have been reported as potential biomarkers for early Pulmonary arterial hypertension diagnosis in previous studies. Betaine is a methyl donor in the formation of methionine, which is vital for protein synthesis in pulmonary arterial smooth muscle cell proliferation. In our study, the betaine level was signi cantly higher in the PAH group than in the control group [2]. Increased betaine may lead to abnormal mitochondrial structure and function and result in energy metabolism disorders. Acetylcarnitine is an acetic acid ester of carnitine that facilitates the movement of acetyl CoA into the mitochondria during fatty acid oxidation. Brittan et al. found that the circulating fatty acid long-chain acylcarnitines are elevated in patients with PAH and are associated with fatty acid accumulation in the myocardium caused by reduced fatty acid

- Cooper GS, Parks CG (2004) Occupational and environmental exposures as risk factors for systemic lupus erythematosus. Curr Rheumatol Rep EU 6:367-374.
- Barbhaiya M, Costenbader KH (2016) Environmental exposures and the development of systemic lupus erythematosus. Curr Opin Rheumatol US 28:497-505.