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L-ARGININE THERAPY FOR PLACENTAL INSUFFICIENCY AND IMPAIRED FETAL PERFUSION :A PRECISION MEDICINE APPROACH INTEGRATING NITRIC OXIDE BIOMARKERS, MICROBIOME AND NUTRIGENOMICS DETERMINANTS

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Abstract

Normal pregnancy requires adequate uteroplacental blood flow, which is largely regulated by nitric oxide (NO) produced from L-arginine via nitric oxide synthase. Nitric oxide plays an essential role in vasodilation, regulation of vascular tone, maintenance of endothelial function, inhibition of platelet aggregation, and improvement of uteroplacental circulation, thereby ensuring sufficient oxygen and nutrient supply to the developing fetus. In certain pregnancy complications such as placental insufficiency, intrauterine growth restriction, and early endothelial dysfunction, nitric oxide bioavailability may decline, leading to impaired vascular relaxation and reduced fetal perfusion. Emerging evidence suggests that factors including maternal microbiome composition, nutrigenomic variations in arginine metabolism, hormonal changes, and metabolic stress may further influence nitric oxide synthesis during pregnancy. However, conventional nutritional supplementation strategies rarely consider these underlying determinants. This study proposes a personalized approach to L-arginine nutritional supplementation by identifying pregnancy-related factors that contribute to nitric oxide depletion and evaluating how targeted nutritional supplementation may improve maternal vascular function and fetal outcomes. Pregnant women presenting with risk indicators of impaired placental circulation will be evaluated for nitric oxide–related biomarkers, metabolic parameters, and nutritional status. Selected participants will receive oral L-arginine nutritional supplementation aimed at restoring nitric oxide production. Additional factors such as maternal microbiome balance, nutrigenomic influences on arginine metabolism, and hormonal profiles will be analyzed to determine their relationship with nitric oxide bioavailability. Maternal hemodynamic parameters and fetal growth indicators will be monitored to assess supplementation response. This approach highlights the potential of precision medicine in obstetric pharmacotherapy, where understanding individual biological factors influencing nitric oxide metabolism could optimize L-arginine therapy and improve maternal-fetal outcomes.

Keywords: L-arginine; Nitric oxide; Uteroplacental blood flow; Nutrigenomics; Maternal microbiome