

Supplementary Table S2: Impact of Specific Sleep Abnormalities on Metabolic Health

Sleep Abnormality	Health Outcomes	Mechanisms
Insomnia	Increased risk of Type 2 diabetes Obesity	Impaired glucose metabolism and insulin sensitivity Increased appetite (via hormonal imbalances, e.g., ghrelin, leptin)
Obstructive Sleep Apnea (OSA)	Insulin resistance and impaired glucose tolerance Increased visceral fat accumulation	Sleep fragmentation leading to sympathetic activation and hormonal changes Intermittent hypoxia and inflammatory pathways
Circadian Rhythm Disorders	Disrupted metabolism, contributing to obesity Impaired glucose regulation	Disruption of metabolic hormones (e.g., cortisol, melatonin)
Sleep Deprivation	Increased fat accumulation	Altered meal timing and insulin resistance Reduced lipolysis and elevated hunger hormones like ghrelin