



## Hormonal Aging and Diabetes: Interactions Between Endocrine Changes and Metabolic Risk

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### Introduction

Aging is accompanied by significant changes in endocrine function, influencing metabolism, body composition, and glucose regulation. Alterations in hormones such as insulin, growth hormone, sex steroids, and cortisol contribute to age-related insulin resistance and increased susceptibility to type 2 diabetes. As life expectancy rises globally, understanding the interplay between hormonal aging and diabetes is essential for developing strategies to prevent metabolic dysfunction, maintain glycemic control, and improve quality of life in older adults [1,2].

### Discussion

One of the primary hormonal changes associated with aging is a decline in insulin sensitivity. Aging is often accompanied by increased visceral adiposity, reduced muscle mass, and changes in adipokine secretion, all of which impair glucose uptake and promote insulin resistance. In response, pancreatic beta cells increase insulin secretion, but with advancing age, beta cell function may decline, contributing to hyperglycemia and the development of type 2 diabetes [3,4].

Growth hormone (GH) and insulin-like growth factor-1 (IGF-1) levels also decrease with age, a phenomenon known as somatopause. Reduced GH/IGF-1 signaling diminishes lean body mass, increases fat accumulation, and impairs glucose homeostasis. Similarly, sex hormone levels decline with aging—testosterone in men and estrogen in women—resulting in adverse effects on body composition, insulin sensitivity, and lipid metabolism. Estrogen deficiency after menopause is particularly associated with increased central adiposity, dyslipidemia, and higher diabetes risk [5].

Cortisol regulation is another critical factor in hormonal aging. Aging can alter circadian cortisol rhythms and increase basal cortisol levels, promoting gluconeogenesis, visceral fat deposition, and insulin resistance. Additionally, aging impacts other metabolic hormones, including adiponectin, leptin, and incretins, contributing to altered appetite regulation, energy balance, and glycemic control.

The cumulative effect of these hormonal changes is an increased prevalence of impaired glucose tolerance and type 2 diabetes in older adults. This metabolic vulnerability is often compounded by comorbidities, physical inactivity, and changes in diet. Clinical management requires attention not only to glycemic control but also to the broader hormonal and metabolic context, including maintaining muscle mass, optimizing body composition, and monitoring cardiovascular risk.

### Conclusion

Hormonal aging significantly influences metabolic regulation and the risk of type 2 diabetes. Declines in insulin sensitivity, growth hormone, sex steroids, and alterations in cortisol and adipokines collectively contribute to impaired glucose homeostasis in older adults. Recognizing these interactions is crucial for prevention, early detection, and tailored management of diabetes in aging populations. Integrative strategies addressing both hormonal and metabolic health can help mitigate diabetes-related complications and enhance overall quality of life in older individuals.

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