Changes in seminal plasma microecological dynamics and the mechanistic impact of the core metabolite hexadecanamide in asthenozoospermia patients

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Introduction

1. From a worldwide perspective, infertility has surged to a prevalence rate of 15%, male infertility currently ranks as the third most prevalent condition, following cancers and cardiovascular disorders. Approximately half of infertility cases are ascribed to male-related factors .

2. Asthenozoospermia (AZS) is a prevalent etiological factor contributing to male infertility, characterized by diminished sperm motility.

3. The etiology of AZS is multifaceted, influenced by various determinants including endocrine disruptors, environmental stressors, individual life trajectories, and the process of aging, although the exact cause remains uncertain.

4. Emerging empirical evidence suggests that the male seminal microbiota is considered a key factor influencing the reproductive health of couples, pregnancy outcomes, and the well-being of offspring. Nevertheless, only a restricted number of studies have delved comprehensively into the composition and functionality of seminal microecology and its association with the development of male infertility.

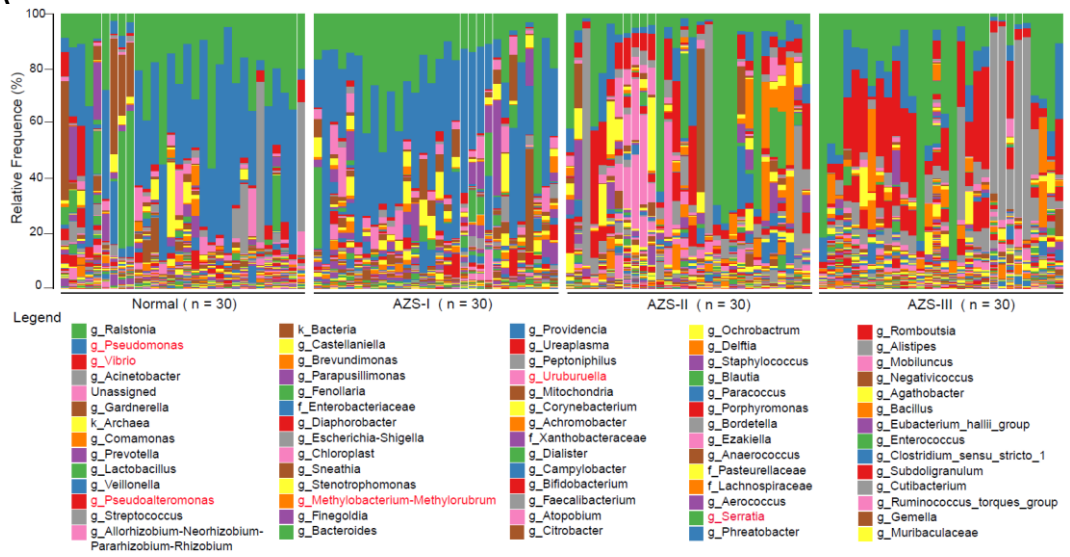
5. To date, there exists a shortage of comprehensive and meticulously detailed analyses pertaining to the microecological dynamics of seminal plasma in individuals afflicted with AZS. This dearth includes both the seminal microbiota and metabolite composition.

6. The objective of this study is to delineate the composition of the seminal plasma microbial community and the metabolic profile, with a particular focus on potential associations with the occurrence of AZS.

Results

1. Microbiome differential abundance analysis revealed significant differences in microbial composition within the seminal plasma between Normal and AZS groups.

A



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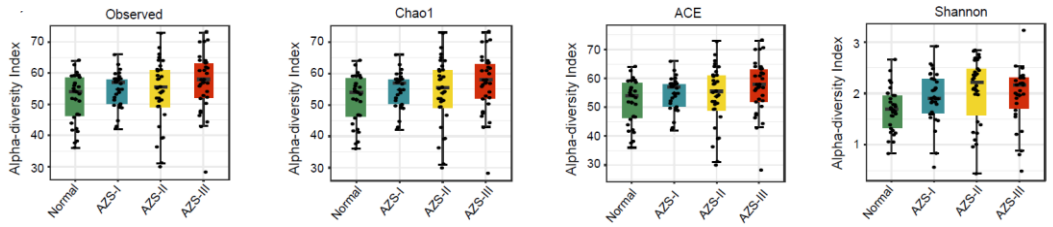

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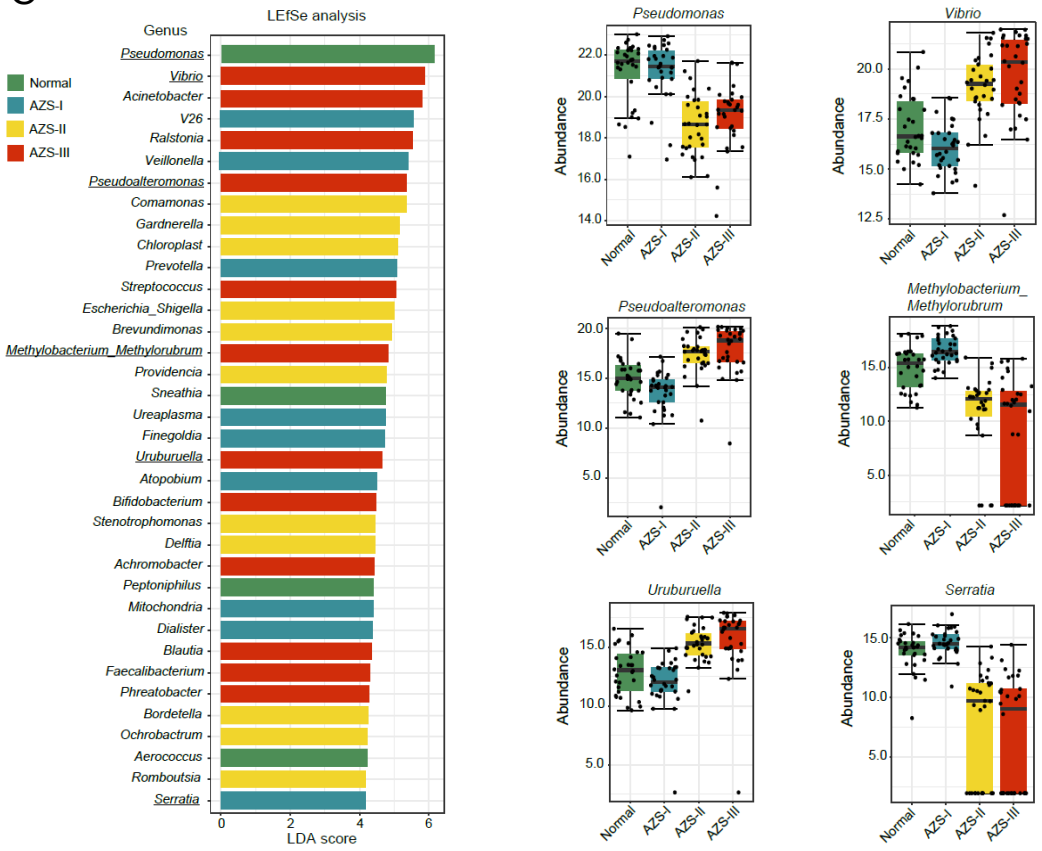
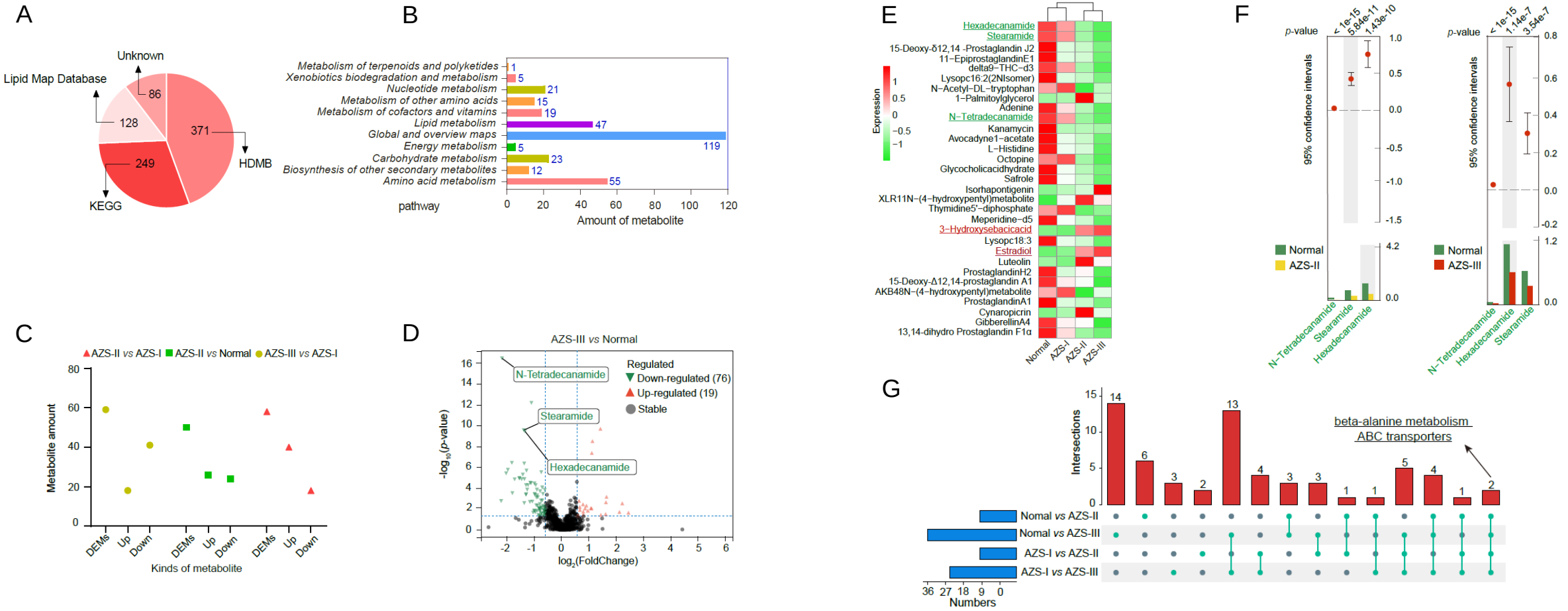


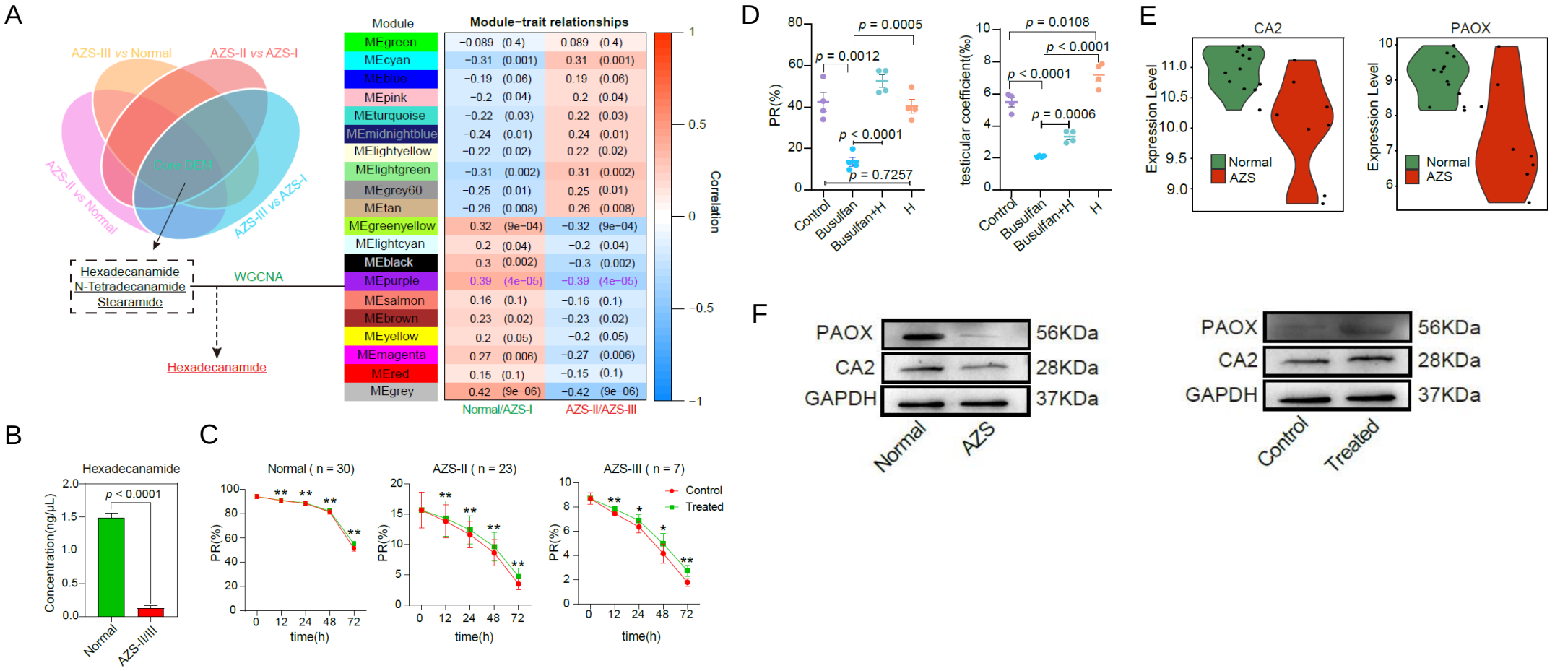
Results

2. Microbiome differential abundance analysis revealed significant differences in metabolite profiles within the seminal plasma between Normal and AZS groups.



Results

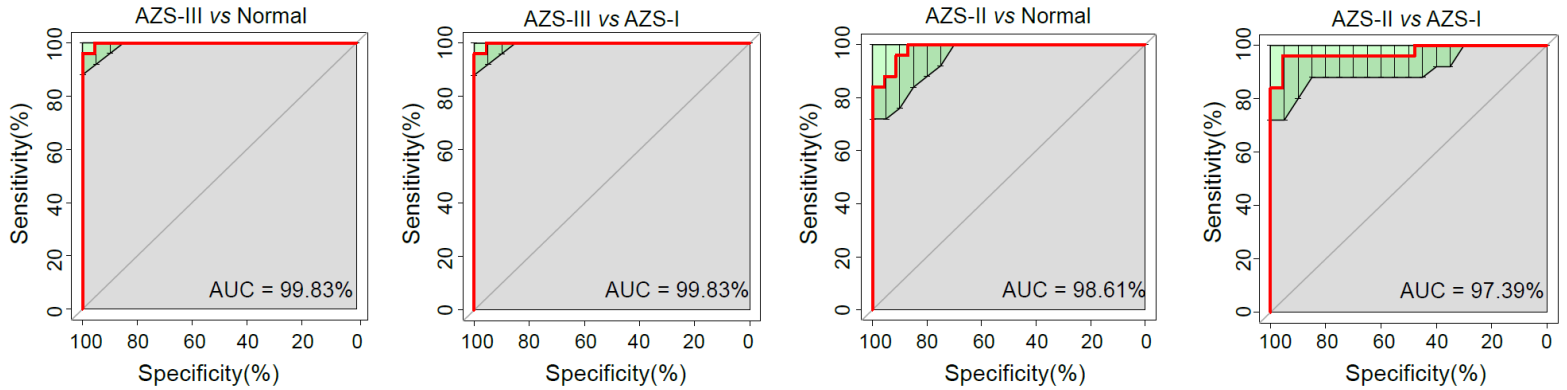
3. Hexadecanamide in seminal plasma may have the capacity to enhance sperm motility by increasing the protein levels of PAOX and CA2 proteins.



Results

4. Screening of several multi-omics profiles that can be used to predict AZS status and subtype and revealed their microbial associations.

A



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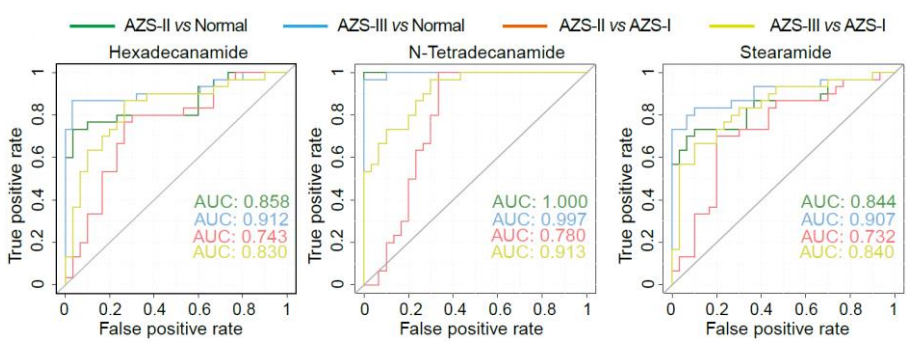

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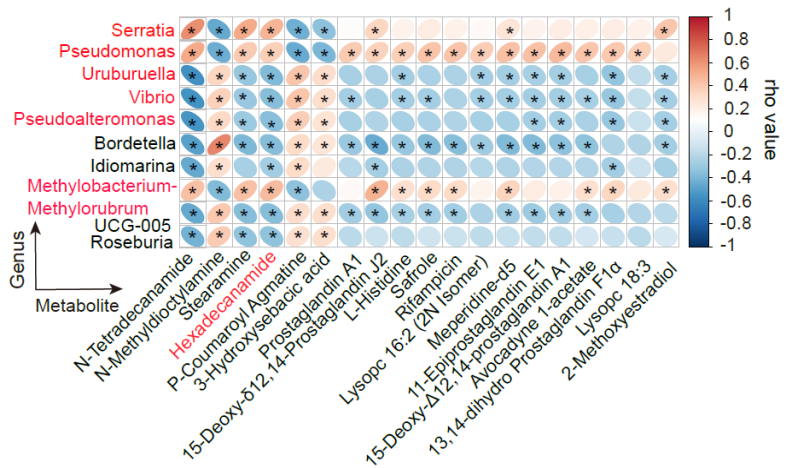


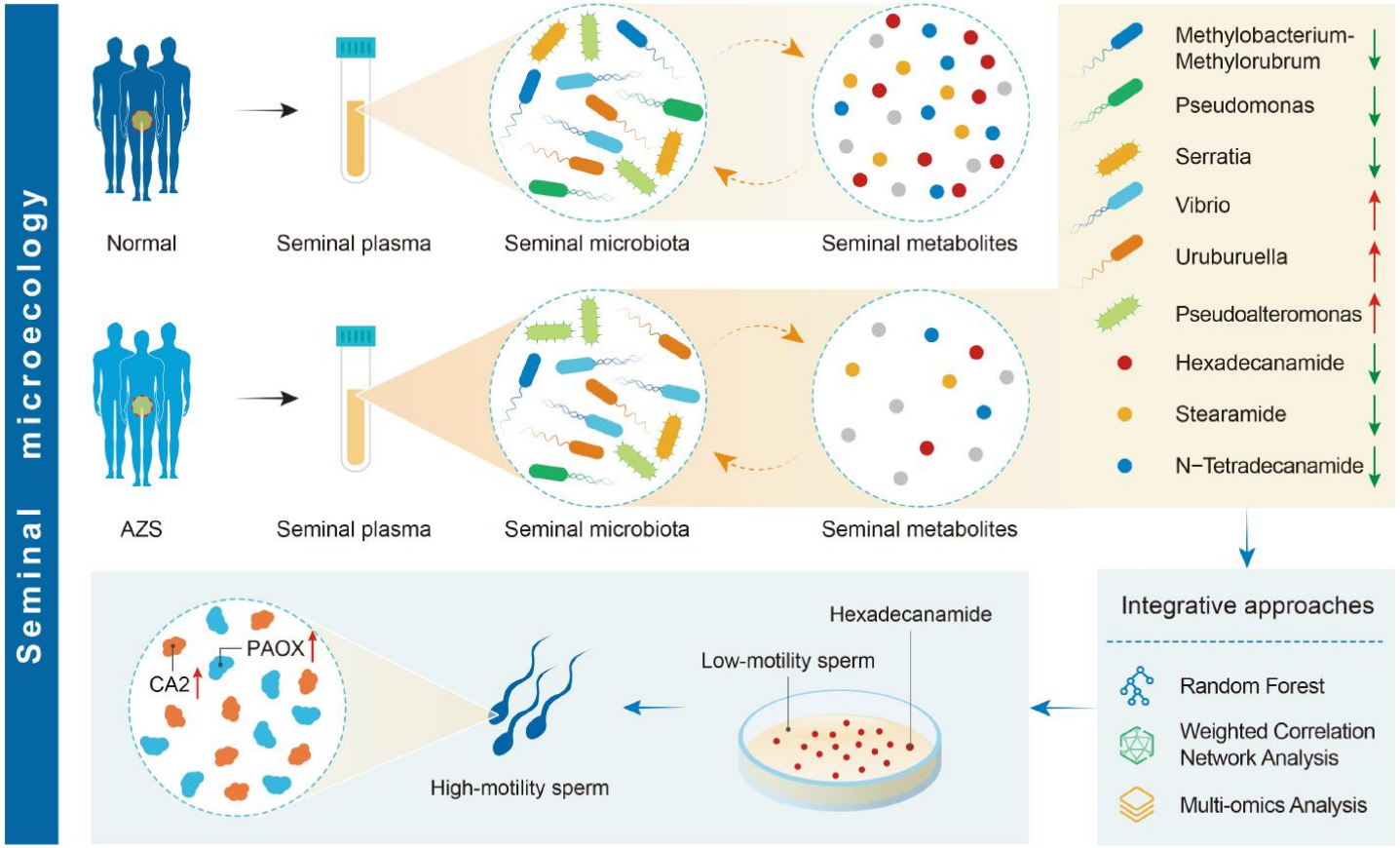
Summary

- This study substantiates the potential clinical diagnostic utility of microbial composition and specific metabolites within seminal plasma for the asthenozoospermia (AZS) identification.

- Divergent microbial compositions and metabolite profiles within seminal plasma are discernible across varying degrees of AZS severity.

- Validation via *in vitro* and *in vivo* experiments corroborates hexadecanamide as a crucial metabolite influencing sperm motility in AZS, coupled with the upregulation of target proteins (PAOX and CA2).

Summary



In the onset of asthenozoospermia (AZS), the presence of six genera of bacteria (*Pseudomonas*, *Serratia*, *Methylobacterium-Methylorubrum*, *Uruburuella*, *Vibrio*, and *Pseudoalteromonas*) in the seminal plasma potentially induces dynamic changes that ultimately reduced the content of hexadecanamide, which contributes to a subsequent decline in sperm motility.

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