

**Supplementary Material**

**Use of sensitivity-enhanced nuclear magnetic resonance spectroscopy equipped with a 1.7-mm cryogenically cooled micro-coil probe in identifying human sperm intracellular metabolites**

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**Supplementary Table S1:** Chemical shift values of the identified sperm intracellular metabolites

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<b>Metabolites</b>	<b>Chemical shift values</b>
Leucine	0.9657
Isoleucine	1.0152
Valine	1.0455
Propylene glycol	1.1444
Ethanol	1.1868
Lactate	1.3304
Alanine	1.4838
Putrescine	3.0557
Betaine	3.2708
Methanol	3.3886
Glycerol	3.5615/3.7809
Tyrosine	6.9043
Formate	8.458

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**Supplementary Table S2.** The different class of metabolites identified in the human sperm (Paiva *et al.* 2014; Engel *et al.* 2018; Zhao *et al.* 2018).

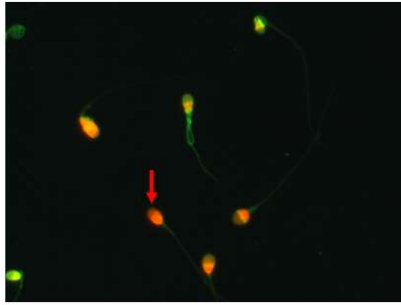
<p><b>Aliphatic cyclic compounds</b></p> <p>Carnitine</p> <p>Methanol</p> <p>O-Phosphocholine</p> <p>Propylene glycol</p> <p>Putrescine</p> <p>Trimethylamine</p> <p>Creatinin</p>	<p>Carnitine and acetyl carnitine are involved in the modulation of fatty acids and transfer acetyl groups into mitochondria for beta-oxidation</p>
<p><b>Amino acids, peptides, and analogues</b></p> <p>2-Amino adipate Aminoisobutyrate Aminobutyrate</p> <p>Gamma-Alanine</p> <p>Arginine</p> <p>Creatine</p> <p>Creatine phosphate</p> <p>Glutamine</p> <p>Isoleucine</p> <p>Leucine</p> <p>Threonine</p> <p>Tyrosine</p> <p>Valine</p>	<p>Can serve as chelating agents, in particular for toxic metals, and/or as oxidizable substrates for spermatozoa.</p> <p>Amino acids could also serve as endogenous substrates in human sperm cells</p>

<p>Tryphtophan</p> <p>Cysteine</p> <p>Proline s</p> <p>Norvaline</p> <p>Aminocaprylic acid</p> <p>5-Aminovaleric acid</p> <p>Asparagine</p> <p>Aspartate</p> <p>Citrulline</p> <p>Glutamate</p> <p>Glycine</p> <p>Histidine</p> <p>Lysine</p> <p>Methionine</p> <p>Ornithine</p> <p>Serine</p> <p>Valine</p>	
<p><b>Carbohydrates and carbohydrate conjugates</b></p> <p>Glucose</p> <p>Glycerol</p> <p>Orotic acid</p> <p>Pipecolinic acid</p>	<p>Indicate the active glycolysis in sperm cells</p>
<p><b>Lipids</b></p>	<p>Indicates the fatty acid oxidation.</p>

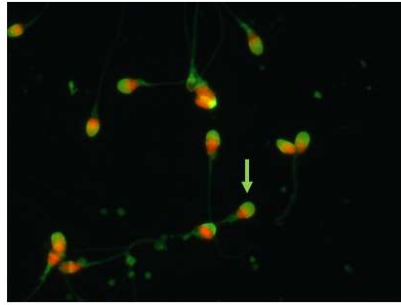
<p>2-Methylglutarate</p> <p>2-Hydroxy-3-</p> <p>1H Butyrate</p> <p>1H Caprate Capric acid</p> <p>1H Caprylate Caprylic acid</p> <p>1H O-Acetylcarnitine L-</p> <p>sn-Glycero-3-phosphocholine</p> <p>Methyl heptadecanoate</p> <p><b>Zymosterol</b> (Zhao et al., 2018)</p> <p>cis-Gondoic acid</p> <p>Phytosphingosine</p>	
<p><b>Nucleosides, nucleotides, and analogues</b></p> <p>ADP</p> <p>Adenosine monophosphate Inosinic acid</p> <p>Cytidine</p> <p>Guanosine</p>	
<p><b>Organic acids and derivatives</b></p> <p>3-Hydroxyisobutyrate</p> <p>2-Oxoglutarate</p> <p>3-Hydroxybutyrate</p> <p>Acetate</p> <p>Azelate</p> <p>Formate</p>	

Glycolate Isobutyrate Lactate Ethanolamine Picolinic acid Benzoic acid Guanidinosuccinic acid pnylethylamine Glutamic acid Dithioerythritol	
<b>Others</b> 2-Aminoethanethiol Monoolein DL-dihydrosphingosine N-(3-aminopropyl)-morpholine alpha-Tocopherol Deoxyerythritol Methylmercaptopurine Amino-1- 5-Aminovaleric acid Phosphoglycerate	

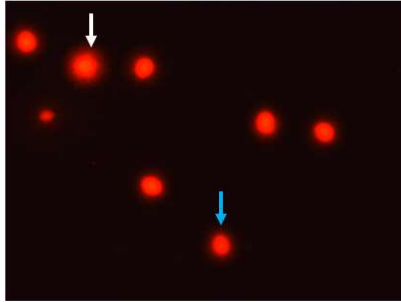
1. A



1. B



1. C



1. D

