

**Supplementary data 1: Table S1: Comparison of larval fatty acid composition for *H. illucens* fed with different mono- and di-saccharides (n=4).**

	<b>BSF-CEL</b>	<b>BSF-FRU</b>	<b>BSF-GAL</b>	<b>BSF-GLU</b>	<b>BSF-LAC</b>	<b>BSF-MAL</b>	<b>BSF-SUC</b>	<b>FEED</b>	<b>Statistical analyses</b>
C10:0	1,27 ± 0.16 a	1.01 ± 0.09 ab	0.98 ± 0.13 ab	0.96 ± 0.13 bc	0.77 ± 0.13 b	1.24 ± 0.14 ac	0.97 ± 0.10 ab	0.00 ± 0.00	F <sub>6,21</sub> =7.336, p<0.001
C12:0	43,10 ± 5.01 a	48.90 ± 1.97 ab	47.46 ± 4.23 ac	48.38 ± 2.17 ab	43.35 ± 1.31 a	54.59 ± 2.17 b	50.74 ± 1.57 bc	0.75 ± 0.00	F <sub>6,21</sub> =7.556, p<0.001
C14:0	5,86 ± 0.44 a	7.12 ± 0.20 b	6.38 ± 0.08 ac	7.12 ± 0.16 b	6.53 ± 0.25 c	6.85 ± 0.19 bc	7.21 ± 0.26 b	0.19 ± 0.04	F <sub>6,21</sub> =15.760, p<0.001
C14:1	0,09 ± 0.02 a	0.23 ± 0.02 ab	0.19 ± 0.03 ab	0.21 ± 0.02 ab	0.21 ± 0.02 ab	0.26 ± 0.03 b	0.26 ± 0.03 b	0.00 ± 0.00	χ <sup>2</sup> =20.587, d.f.6, p<0.001
C16:0	12,36 ± 1.05 ab	11.67 ± 0.09 ab	11.89 ± 1.14 ab	11.83 ± 0.38 ab	12.85 ± 0.27 a	10.46 ± 0.77 b	11.42 ± 0.27 ab	15.69 ± 0.05	χ <sup>2</sup> =15.213, d.f.6, p<0.050
C16:1	2,61 ± 0.04 a	1.96 ± 0.13 b	2.12 ± 0.23 b	1.90 ± 0.16 b	2.64 ± 0.20 a	2.10 ± 0.20 b	2.13 ± 0.13 b	0.00 ± 0.00	F <sub>6,21</sub> =12.320, p<0,001
C17:0	0,16 ± 0.03	0.06 ± 0.03	0.00 ± 0.00	0.06 ± 0.01	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	/
C17:1	0,16 ± 0.01	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	/
C18:0	2,38 ± 0.28 a	1.67 ± 0.16 ab	1.60 ± 0.24 ab	1.73 ± 0.15 ab	1.66 ± 0.11 ab	1.37 ± 0.06 b	1.54 ± 0.30 ab	2.30 ± 0.9	χ <sup>2</sup> =15.802, d.f.6, p=0.001
C18:1n9 cis+trans	12,40 ± 1.31 ab	10.85 ± 0.66 ac	11.17 ± 1.30 bc	10.98 ± 0.67 bc	12.86 ± 0.52 b	9.52 ± 0.50 c	10.52 ± 0.50 ac	23.22 ± 0.02	F <sub>6,21</sub> =7.021, p<0.001
C18:2n6 cis	13,41 ± 2.48 ab	15.09 ± 1.18 ab	16.38 ± 1.40 a	15.24 ± 0.80 ab	17.22 ± 0.46 a	12.58 ± 0.67 b	14.09 ± 0.41 ab	54.81 ± 0.06	χ <sup>2</sup> =19.227, d.f.6, p<0.001
C18:3n3	0,72 ± 0.18 ab	0.61 ± 0.04 ab	0.82 ± 0.05 ac	0.62 ± 0.01 ab	0.87 ± 0.02 a	0.49 ± 0.04 b	0.57 ± 0.04 bc	2,51 ± 0.04	χ <sup>2</sup> =20.054, d.f.6, p<0.001
UND9	2,46 ± 0.52 a	0.14 ± 0.02 ab	0.07 ± 0.08 b	0.20 ± 0.04 a	0.19 ± 0.03 b	0.00 ± 0.00 b	0.12 ± 0.04 b	0.00 ± 0.00	χ <sup>2</sup> =22.726, d.f.6, p<0.001
C20:0	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.34 ± 0.00	/
C20:1n9	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.20 ± 0.01	/
SFA	64,96 ± 4,27 a	70,37 ± 1,97 bcd	68,31 ± 3,02 ad	70,04 ± 1,64 ac	65,17 ± 1,28 ab	74,52 ± 1,41 c	71,88 ± 1,04 cd	19.27 ± 0.05	F <sub>6,21</sub> =8.742, p<0,001
MUFA	15,11 ± 1,29 ab	13,04 ± 0,79 bc	13,48 ± 1,51 ac	13,10 ± 0,83 bc	15,71 ± 0,73 a	11,89 ± 0,72 c	12,91 ± 0,63 bc	23.42 ± 0.00	F <sub>6,21</sub> =7.472, p<0,001
PUFA	14,13 ± 2,66 ab	15,70 ± 1,23 ab	17,20 ± 1,38 a	15,86 ± 0,81 ab	18,09 ± 0,48 a	13,07 ± 0,72 b	14,66 ± 0,45 ab	57.32 ± 0.10	χ <sup>2</sup> =16.605, d.f.6, p<0.001
Identified FAME's	94,20 ± 0,53 a	99,10 ± 0,05 ab	98,98 ± 0,13 ab	98,99 ± 0,05 ab	98,96 ± 0,10 ab	99,47 ± 0,07 b	99,44 ± 0,07 b	100.0(± 0.00	χ <sup>2</sup> =29.539, d.f.6, p<0.001

Means ±SD within a column followed by different letters are significantly different (p<0.05). χ<sup>2</sup> are presented for Kruskal-Wallis test. F value are presented for ANOVA test.

BSF Black Soldier Fly, CEL Cellulose, FRU Fructose, GAL Galactose, GLU Glucose, LAC Lactose, MAL Maltose, SUC Sucrose. FEED correspond to the initial fatty acid composition of the diet.



Supplementary data 2: Tab. S2: Initial individual weight of *Hermetia illucens* larvae harvested 5 days post-hatch for feeding experiment:

Carbohydrates	Mean individual weight at day 0 ± SD (mg)	
CELLULOSE	7.128 ± 0.49	a
FRUCTOSE	7.118 ± 0.15	a
GALACTOSE	7.280 ± 0.49	a
GLUCOSE	7.000 ± 0.38	a
LACTOSE	7.063 ± 0.45	a
MALTOSE	7.065 ± 0.21	a
SUCROSE	7.223 ± 0.44	a
Statistical analyses	F <sub>6,21</sub> = 0.181, p>0.05	

*Means with different letters significantly differ.*

Supplementary data 3 : Tab. S3 : Instrumental details of GCxGC-FID method used for fatty acid identification

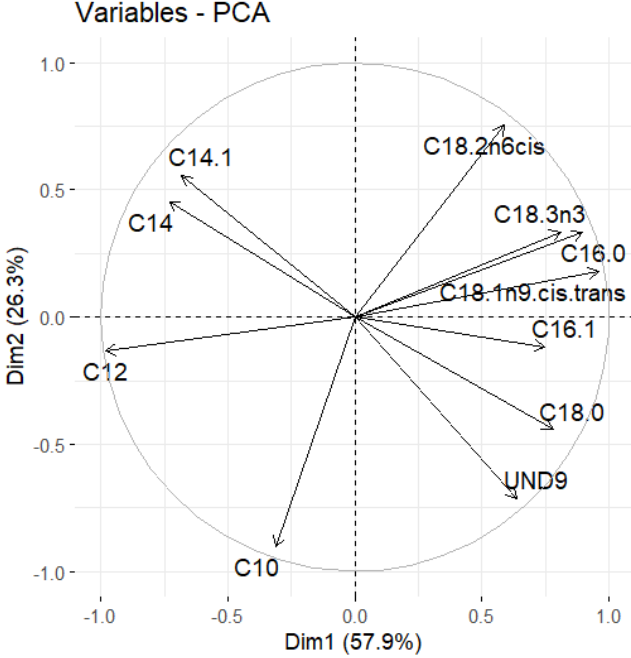
<b>GCxGC-FID PARAMETERS</b>		
<b>Carrier gas</b>	Helium	
<b><sup>1</sup>D flow-rate</b>	0.5 mL/min	
<b><sup>2</sup>D flow-rate</b>	20 mL/min	
<b>Modulation period</b>	4 s	
<b>Reinjection time</b>	100 ms	
<b>Oven Temperature program</b>	2 min at 40°C; from 40 to 250°C at 11°C/min and hold it for 2 min	
<b>Injection mode</b>	Split mode (1:20)	
<b>Injection volume</b>	1.0 µL	
<b>Injector Temperature</b>	250 °C	
<b>FID Temperature</b>	250 °C	
<b>FID data acquisition frequency</b>	100 Hz	
<b>FID parameters</b>	airflow: 300 mL/min, H2: 30 mL/min; make-up gas: 10 mL/min	
<b>Instrumentation</b>		
<b>Autosampler</b>	AOC-30i Autoinjector	Shimadzu
<b>GC</b>	Nexi GC-2030	Shimadzu
<b>Detector</b>	FID	Shimadzu
<b><sup>1</sup>D column</b>	<sup>1</sup> D-FAMES 20m x 0.18 mm x 0.1 µm polar fused silica capillary column	SepSolve
<b><sup>2</sup>D column</b>	2D-FAMES 5m x 0.25 mm x 0.1 µm non-polar fused silica capillary column	SepSolve
<b>Bleedline</b>		SepSolve
<b>Modulator</b>	Revered fill/flush INSIGHT flow modulator	SepSolve
<b>Software</b>		
<b>Data acquisition</b>	LabSolution Version 5.111	Shimadzu
<b>Data Processing</b>	ChromSpace Version 1.5.1	Markes International Limited

Method adapted from :

[19] Ferrara, D.; Cescon, M.; Giacoppo, G.; Costa, V.; Purcaro, G.; Spadafora, N.D.; Cordero, C.; Pasti, L.; Cavazzini, A.; Beccaria, M. Composition and Nutritional Values of Fatty Acids in Marine Organisms by One-Step Microwave-Assisted Extraction/Derivatization and Comprehensive Two-Dimensional Gas Chromatography -Flame Ionization Detector. *Journal of Chromatography B* **2024**, 1236, 124074, doi:10.1016/j.jchromb.2024.124074.

Supplementary data 4 :

Fig. S4 : PCA circle correlation for fatty acid profiles of *Hermetia illucens* larvae fed with different carbohydrates:



Supplementary data 5 :

Fig. S5: Comprehensive two-dimensional GC (GC×GC-FID) chromatogram for fatty acid profiles of *Hermetia illucens* larvae fed with chicken feed and cellulose diet. The unidentified compound 9 is indicated by an arrow:

