

**Supplementary Information - Behavioural results****Medawar et al.****Additional behavioral assessments**

**Liking ratings** of food and art stimuli were collected similar to wanting ratings, yet outside the MR scanner and after all pre- and post-intervention visits. In one session (about 1h30min), 720 stimuli were presented on a computer screen under standardized conditions (all from the wanting task across all sessions, plus additional ones). Participants were asked “How much do you like this in general” (German original: “Wie sehr mögen Sie dies generell?”) and responded by moving a trial-by-trial randomly placed cursor on a 8-point Likert scale (1 = “not at all”, 8 = “absolutely”; German original: 1 = “überhaupt nicht”, 8 = “äußert gern”) with arrow buttons. Diverging from the MR setting, here each stimuli was presented up to 10s and participants could actively confirm their rating choice by clicking the space bar. Participants were explicitly instructed to report general liking, and that no post-experiment reward was provided. Time of day was not standardized and fasted state not acquired for this day.

*[Detailed instructions: “Sie können eine Wertung zwischen 1 und 8 auswählen. 1 bedeutet, dass Sie das Lebensmittel so abstoßend finden, dass Sie es unter keinen Umständen essen würden, und 8 bedeutet, dass Sie das Lebensmittel so lecker finden, dass Sie es jederzeit sehr gerne essen würden. Für die Kunstbilder bedeutet 1, dass Sie das Bild so hässlich finden, dass Sie es nicht ansehen möchten, und 8 bedeutet, dass Sie es so schön finden, dass Sie den Blick nicht abwenden möchten. Zum Fortfahren bitte LEERTASTE drücken.”]*

**Food intake.** The DEGS-1 German Food Frequency Questionnaire (FFQ) [1] was used to assess habitual dietary intake for the last 24h and the last 7 days at each timepoint. We developed a pipeline to compute daily nutrient intake based on self-reported dietary habits [2]. We did this by combining computed mean daily portion [g] based on DEGS-1 FFQ and corresponding nutrient information based on reference nutrient data (using the German Nutrient Reference Database “Bundeslebensmittelschlüssel” version 3.02) for each of the 53 items. This resulted in mean daily intake of macro- and micronutrients, e.g. daily fiber intake in grams.

**Traits.** The following questionnaires were administered once for each individual at the pre-baseline assessment: personality traits (NEOFFI-30) [3], Three-Factor Eating Questionnaire (TFEQ) [4], Eating Disorder Examination Questionnaire (EDEQ) [5], art knowledge (VAIAK) [6], physical activity (IPAQ), general well-being (8-item Eurohis QoL and 5-item WHO-5), trait anxiety (STADI-T) [7] and impulsivity (BIS-15) [8].

**States.** The following questionnaires were administered at each intervention visit: sleep quality of the last 24h and last 7 days (SF-A/R, SF-B/R) [9], gastrointestinal quality of life (GIQLI) [10], personality states (BFMM), changes to physical activity, depressive symptoms (Beck Depression Inventory, BDI) [11], well-being (WHO-5), state anxiety (STADI-S) [7], mood (POMS) [12], affect (PANAS) [13].

**Behavioral hypotheses and codes.** Please see preregistration and code at <https://osf.io/f6qz5> and [https://gitlab.gwdg.de/gut\\_brain\\_study/food-wanting/task-fmri-behavior-analysis](https://gitlab.gwdg.de/gut_brain_study/food-wanting/task-fmri-behavior-analysis) for details on hypotheses and according set-up of statistical models.

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## Behavioral Results

**SI-Table 1: Wanting ratings by stimulus category and stimulus type by timepoint for each intervention arm.** Based on means of individuals for each stimulus type. sd = standard deviation.

timepoint	intervention	stim_category	stim_type	variable	n	mean	sd
BL	placebo	F	cal1	wanting	53	3.394	1.15
BL	placebo	F	cal2	wanting	53	4.173	1.078
BL	placebo	F	cal3	wanting	53	3.844	1.107
BL	placebo	F	cal4	wanting	53	3.521	1.155
BL	placebo	NF	animals	wanting	53	3.662	1.164
BL	placebo	NF	plants	wanting	53	3.245	1.181
BL	placebo	NF	objects	wanting	53	2.401	0.87
BL	fiber	F	cal1	wanting	55	3.532	1.235
BL	fiber	F	cal2	wanting	55	4.204	1.221
BL	fiber	F	cal3	wanting	55	3.797	1.21
BL	fiber	F	cal4	wanting	55	3.724	1.168
BL	fiber	NF	animals	wanting	55	3.608	1.323
BL	fiber	NF	plants	wanting	55	3.562	1.378
BL	fiber	NF	objects	wanting	55	2.399	0.91
FU	placebo	F	cal1	wanting	49	3.294	1.286
FU	placebo	F	cal2	wanting	49	3.991	1.288
FU	placebo	F	cal3	wanting	49	3.653	1.059
FU	placebo	F	cal4	wanting	49	3.391	1.112
FU	placebo	NF	animals	wanting	49	3.422	1.217
FU	placebo	NF	plants	wanting	49	3.329	1.412

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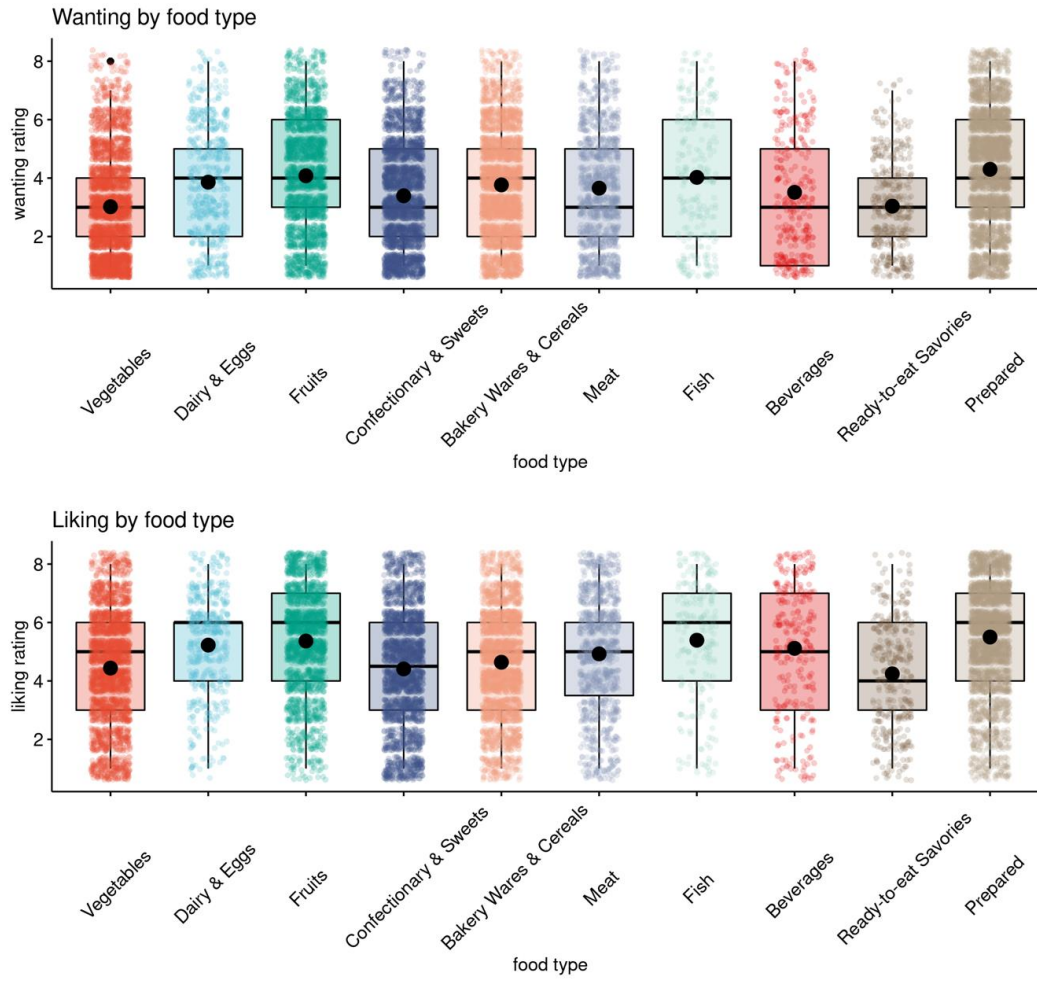
<b>FU</b>	placebo	NF	objects	wanting	49	2.369	947
<b>FU</b>	fiber	F	cal1	wanting	47	3.212	1.218
<b>FU</b>	fiber	F	cal2	wanting	47	4.074	1.34
<b>FU</b>	fiber	F	cal3	wanting	47	3.755	1.186
<b>FU</b>	fiber	F	cal4	wanting	47	3.398	1.116
<b>FU</b>	fiber	NF	animals	wanting	47	3.447	1.338
<b>FU</b>	fiber	NF	plants	wanting	47	3.165	1.328
<b>FU</b>	fiber	NF	objects	wanting	47	2.259	906

*BL baseline, F Food, FU follow-up, NF Non-food*

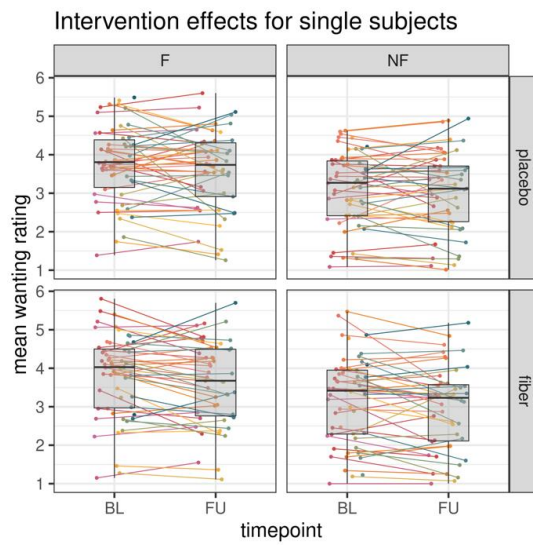
Preregistered linear models for model 1/A (food vs. art), model 2/A (intervention effect) for different stimulus classes (stimulus category, stimulus type) for either average across class or stimulus-by-stimulus values (note number of observations:  $n_{\text{obs}_{\text{category}}} > 1,470$ ,  $n_{\text{obs}_{\text{stimulus}}} > 32,000$ ) are reported here.

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SI-Fig. 2: Distribution of food wanting and liking ratings by food type.

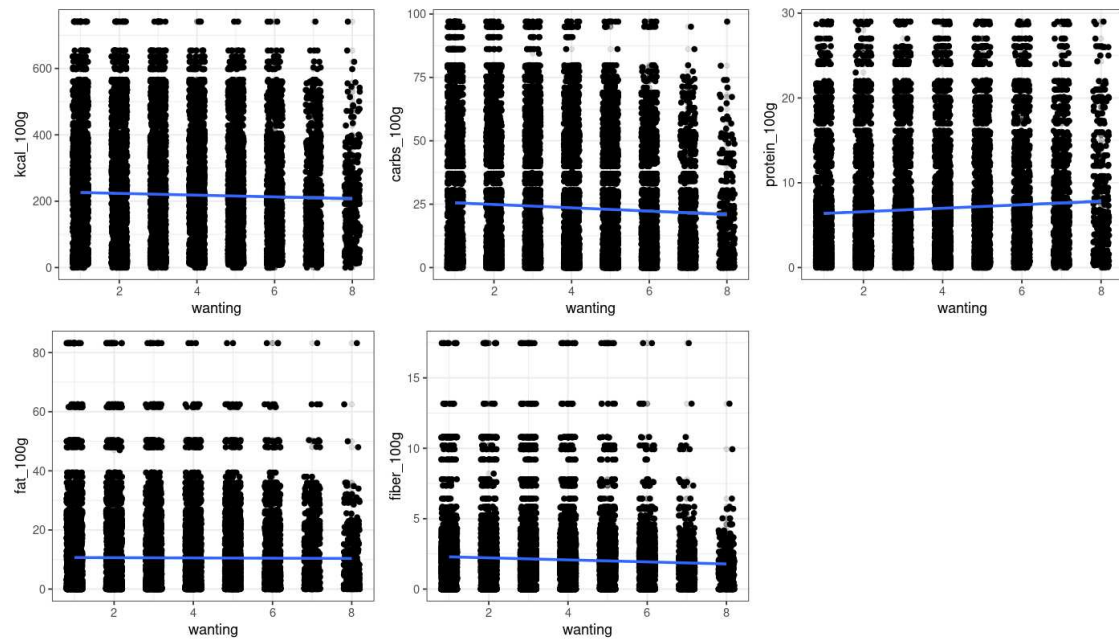


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**SI-Fig. 3: Intervention effects on wanting ratings by stimulus category and timepoint.** Average and individual ratings by timepoint and by intervention depicting inter-individual variability in wanting ratings.

Food items higher in protein/100g ( $b = 0.02$ ,  $t = 3.35$ ), lower in fiber/100g ( $b = -0.06$ ,  $t = -3.51$ ), and to a lesser extent, lower in carbohydrates/100g ( $b = -0.004$ ,  $t = -2.22$ ) were more wanted ( $p_{\text{all}} < .03$ ).



**SI-Fig. 4: Food wanting ratings correlate with nutrient content.**

**Model 1/A: Main effect of stimulus category (food vs. art)**

H\_behav\_0.1: Individual wanting is higher for food compared to art wanting for between-subject analysis ( $b = 1.03$ ,  $t = 7.78$ , null model comparison  $p < 0.001$ ).

**SI-Table 2: Mixed effects linear model results on the subjective wanting for food and art stimuli on the level of stimulus category.**

random effects	variance	SD	
subject (intercept)	0.73	0.86	
stim_category (food)	1.00	1.00	
residual	2.47	1.57	
fixed effects	estimate	SE	t-value
(intercept)	2.77	0.11	23.94
<b>stim_category (food)</b>	<b>1.03***</b>	<b>0.13</b>	<b>7.78</b>
time (follow-up)	-0.05	0.03	-2.05
intervention (prebiotic)	0.10	0.03	4.03
time (follow-up) * intervention (prebiotic)	-0.13	0.04	-3.58

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**Formula:**  $wanting \sim stim\_category + timepoint * intervention + (stim\_category | subject)$ . **REML criterion at convergence:** 120620,  $n_{obs} = 32,111$ , **groups:**  $n_{subj} = 59$ . **Significance,** \*\*\*  $p < 0.001$

**Additional analysis for stimulus type**

**SI-Table 3: Mixed effects linear model results on the subjective wanting for food and art stimuli on the level of stimulus type.**

random effects	variance	SD	
subject (intercept)	0.57	0.75	
residual	2.54	1.60	
fixed effects	estimate	SE	t-value
(Intercept)	3.41	0.10	33.24
<b>stim_typecal2</b>	<b>0.75***</b>	<b>0.04</b>	<b>20.99</b>
<b>stim_typecal3</b>	<b>0.40***</b>	<b>0.04</b>	<b>11.08</b>
<b>stim_typecal4</b>	<b>0.14***</b>	<b>0.04</b>	<b>4.02</b>
<b>stim_typeanimals</b>	<b>0.18***</b>	<b>0.04</b>	<b>4.31</b>
<b>stim_typeplants</b>	<b>-0.04***</b>	<b>0.04</b>	<b>-0.91</b>
<b>stim_typeobjects</b>	<b>-1.01***</b>	<b>0.03</b>	<b>-34.36</b>
time (follow-up)	-0.05	0.03	-2.00
intervention (prebiotic)	0.10	0.03	4.00
time (follow-up) * intervention (prebiotic)	-0.13	0.04	-3.52

**Formula:**  $wanting \sim stim\_type + timepoint * intervention + (1 | subject)$ . **REML criterion at convergence:** 121425,  $n_{obs} = 32,111$ , **groups:**  $n_{subj} = 59$ . **Significance,** \*\*\*  $p < 0.001$ .

**Note:** No random slope "stimulus type" as model couldn't converge -> only random intercept "subject".

**Additional analysis for food type (10 types)**

All types of food are more liked than vegetables with fruits, fish and prepared most liked (between-subject) ( $b_{all} > 0.03$ ,  $t_{all} > 0.38$ , null model comparison  $p < 0.001$ ).

**SI-Table 4: Mixed effects linear model results on the subjective wanting for food stimuli on the level of food-pics type (food only).**

random effects	variance	SD	
subject (intercept)	0.90	0.95	
residual	2.58	1.61	
fixed effects	estimate	SE	t-value
(intercept)	3.08	0.13	23.82
<b>type1 - Dairy &amp; eggs</b>	<b>0.84***</b>	<b>0.07</b>	<b>11.29</b>
<b>type2 - Fruits</b>	<b>1.06***</b>	<b>0.05</b>	<b>22.90</b>
<b>type4 - Confectionary &amp; sweets</b>	<b>0.38***</b>	<b>0.04</b>	<b>8.77</b>
<b>type5 - Bakery wares &amp; cereals</b>	<b>0.75***</b>	<b>0.04</b>	<b>17.72</b>
<b>type6 - Meat</b>	<b>0.63***</b>	<b>0.06</b>	<b>11.08</b>
<b>type7 - Fish</b>	<b>1.01***</b>	<b>0.11</b>	<b>9.48</b>
<b>type8 - Beverages</b>	<b>0.50***</b>	<b>0.10</b>	<b>5.15</b>
<b>type9 - Ready-to-eat savories</b>	<b>0.03***</b>	<b>0.09</b>	<b>0.38</b>
<b>type10 - Prepared</b>	<b>1.28***</b>	<b>0.04</b>	<b>30.51</b>

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time (follow-up)	-0.11	0.04	-2.94
intervention (prebiotic)	0.10	0.04	2.73
time (follow-up) * intervention (prebiotic)	-0.09	0.05	-1.71

Formula:  $wanting \sim food\_pics\_type + timepoint * intervention + (1 | subject)$ , data = data\_F\_only. REML criterion at convergence: 61111,  $n_{obs} = 16,071$ , groups:  $n_{subj} = 59$ . Significance, \*\*\*  $p < 0.001$ .

No random slope "food pics type" as model couldn't converge -> only random intercept "subject".

**Additional analysis for nutrient content (macronutrients)**

**SI-Table 5: Mixed effects linear model results on the subjective wanting for stimuli per nutrient content (food only).** Less fiber content and higher amounts of protein and carbohydrates related to higher wanting.

fixed effects	estimate	SE	t-value
(Intercept)	3.79	0.14	27.16
kcal_100g	-0.00	0.00	-0.86
time (follow-up)	-0.11	0.04	-3.04
intervention (prebiotic)	0.10	0.03	2.90
time (follow-up) * intervention (prebiotic)	-0.09	0.05	-1.80
(Intercept)	3.88	0.14	28.45
<b>fiber_100g</b>	<b>-0.06***</b>	<b>0.02</b>	<b>-3.51</b>
time (follow-up)	-0.11	0.04	-3.04
intervention (prebiotic)	0.10	0.03	2.91
time (follow-up) * intervention (prebiotic)	-0.09	0.05	-1.80
(Intercept)	3.62	0.14	26.37
<b>protein_100g</b>	<b>0.02***</b>	<b>0.01</b>	<b>3.35</b>
time (follow-up)	-0.11	0.04	-3.04
intervention (prebiotic)	0.10	0.03	2.91
time (follow-up) * intervention (prebiotic)	-0.09	0.05	-1.81
(Intercept)	3.75	0.13	27.79
fat_100g	0.00	0.00	0.10
time (follow-up)	-0.11	0.04	-3.04
intervention (prebiotic)	0.10	0.03	2.91
time (follow-up) * intervention (prebiotic)	-0.09	0.05	-1.80
(Intercept)	3.83	0.14	28.11
<b>carbs_100g</b>	<b>-3.5*10<sup>-3</sup>*</b>	<b>1.5*10<sup>-3</sup></b>	<b>-2.22</b>
time (follow-up)	-0.11	0.04	-3.04
intervention (prebiotic)	0.10	0.03	2.91
time (follow-up) * intervention (prebiotic)	-0.09	0.05	-1.80

Formula:  $wanting \sim nutrient\_of\_interest\_pics\_type + timepoint * intervention + (1 | subject) + (1 | image\_number)$ , data = data\_F\_only. For each model  $n_{obs} = 16,071$ , groups:  $n_{subj} = 59$ ,  $n_{images} = 410$ . Significance, \*/\*\*\* ANOVA null-full model comparison  $p < 0.05 / p < 0.001$



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**Additional analysis for H\_behav\_0.1 with hunger rating as covariate****SI-Table 6: Mixed effects linear model results on the subjective wanting for subjective hunger rating on wanting by stimulus category.**

random effects	variance	SD	
subject (intercept)	0.72	0.85	
stim_category (food)	0.96	0.98	
residual	2.46	1.57	
fixed effects	estimate	SE	t-value
(intercept)	2.59	0.13	19.96
stim_category (food)	0.82	0.16	5.16
hunger (mean pre-/post-wanting task)	0.03	0.02	2.01
time (follow-up)	-0.06	0.03	-2.17
intervention (prebiotic)	0.08	0.03	3.05
time (follow-up) * intervention (prebiotic)	-0.11	0.04	-3.05
<b>stim_category (food) * hunger (mean)</b>	<b>0.05*</b>	<b>0.02</b>	<b>2.28</b>

Formula: wanting ~ stim\_category \* hunger\_mean\_wanting + stim\_category + hunger\_mean\_wanting + timepoint\*intervention + (stim\_category | subject). REML criterion at convergence: 120603, n\_obs = 32,111, groups: n\_subj = 59. Significance, \* p < 0.05

**Model 2/A: Intervention effect**

H\_behav\_A0: Individual food wanting compared to art wanting is not significantly different after a two-week high-fiber intervention, when looking at stimulus category (R1 with timepoint\*intervention\*stim\_category vs. R0, p = 0.317, **SI-Table 7**), but for stimulus type (R1 with timepoint\*intervention\*stim\_type vs. R0, p = 0.002, **SI-Table 8**).

**SI-Table 7a: Mixed effects linear model results on the subjective wanting for post-intervention by stimulus category. Alternative model (H1) including triple interaction (time (follow-up) \* intervention (prebiotic) \* stim\_category (food)).**

random effects	variance	SD	
subject (intercept)	0.69	0.83	
time (follow-up)	0.07	0.27	
stim_category (food)	1.00	1.00	
intervention (prebiotic)	0.13	0.36	
residual	2.41	1.55	
fixed effects	estimate	SE	t-value
(intercept)	2.69	0.11	24.03
time (follow-up)	0.01	0.05	-0.17
intervention (prebiotic)	0.10	0.06	1.69
stim_category (food)	1.06	0.14	7.82
time (follow-up) * intervention (prebiotic)	-0.15	0.05	-2.94
time (follow-up) * stim_category (food)	-0.11	0.05	-2.14
intervention (prebiotic) * stim_category (food)	-0.002	0.05	-0.05
time (follow-up) * intervention (prebiotic) * stim_category (food)	0.07	0.07	1.00

Formula: wanting ~ timepoint\*intervention\*stim\_category+ timepoint\*stim\_category+ timepoint\*intervention+ stim\_category\*intervention+ timepoint+ stim\_category+ intervention+( 1+timepoint\*intervention|subject). REML criterion at convergence: 120207, n\_obs = 32,111, groups: n\_subj = 59. Significance, p = 0.317



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**SI-Table 7b: Mixed effects linear model results on the subjective wanting for post-intervention by stimulus category. Null model (H0) without triple interaction (time (follow-up) \* intervention (prebiotic) \* stim\_category (food)).**

random effects	variance	SD	
subject (intercept)	0.69	0.83	
time (follow-up)	0.07	0.27	
stim_category (food)	1.00	1.00	
intervention (prebiotic)	0.13	0.36	
residual	2.41	1.55	
fixed effects	estimate	SE	t-value
(intercept)	2.70	0.11	24.20
time (follow-up)	0.01	0.05	-0.18
intervention (prebiotic)	0.09	0.06	1.47
stim_category (food)	1.04	0.13	7.76
<b>time (follow-up) * intervention (prebiotic)</b>	<b>-0.11**</b>	<b>0.04</b>	<b>-3.14</b>
time (follow-up) * stim_category (food)	-0.07	0.04	-2.03
intervention (prebiotic) * stim_category (food)	-0.03	0.04	-0.90

Formula:  $wanting \sim timepoint * stim\_category + timepoint * intervention + stim\_category * intervention + timepoint + stim\_category + intervention + (1 + timepoint * intervention | subject)$ . REML criterion at convergence: 120205,  $n_{obs} = 32,111$ , groups:  $n_{subj} = 59$ .

**SI-Table 8: Mixed effects linear model results on the subjective wanting for post-intervention by stimulus type.**

random effects	variance	SD	
subject (intercept)	0.53	0.73	
time (follow-up)	0.07	0.27	
intervention (prebiotic)	0.13	0.36	
residual	2.50	1.58	
fixed effects	estimate	SE	t-value
(intercept)	3.39	0.11	31.34
time (follow-up)	-0.03	0.08	-0.41
intervention (prebiotic)	0.19	0.07	2.15
stim_type (cal2)	0.78	0.07	11.24
stim_type (cal3)	0.45	0.07	6.47
stim_type (cal4)	0.13	0.07	1.80
stim_type (animals)	0.28	0.08	3.50
stim_type (plants)	-0.15	0.08	-1.87
stim_type (objects)	-0.99	0.06	-17.33
time (follow-up) * intervention (prebiotic)	-0.25	0.10	-2.47
time (follow-up) * stim_type (cal2)	-0.09	0.10	-0.88
time (follow-up) * stim_type (cal3)	-0.10	0.10	-1.00
time (follow-up) * stim_type (cal4)	-0.04	0.10	-0.43
time (follow-up) * stim_type (animals)	-0.16	0.12	-1.40
time (follow-up) * stim_type (plants)	0.17	0.12	1.50

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time (follow-up) * stim_type (objects)	0.05	0.08	0.56
intervention (prebiotic) * stim_type (cal2)	-0.10	0.10	-1.06
intervention (prebiotic) * stim_type (cal3)	-0.18	0.10	-1.88
intervention (prebiotic) * stim_type (cal4)	0.06	0.10	0.66
intervention (prebiotic) * stim_type (animals)	-0.20	0.11	-1.83
intervention (prebiotic) * stim_type (plants)	0.18	0.11	1.59
intervention (prebiotic) * stim_type (objects)	-0.14	0.08	-1.74
<b>time (follow-up) * intervention (prebiotic) * stim_type (cal2)</b>	<b>0.27**</b>	<b>0.14</b>	<b>1.94</b>
<b>time (follow-up) * intervention (prebiotic) * stim_type (cal3)</b>	<b>0.37**</b>	<b>0.14</b>	<b>2.61</b>
<b>time (follow-up) * intervention (prebiotic) * stim_type (cal4)</b>	<b>0.03**</b>	<b>0.14</b>	<b>0.21</b>
<b>time (follow-up) * intervention (prebiotic) * stim_type (animals)</b>	<b>0.33**</b>	<b>0.16</b>	<b>2.02</b>
<b>time (follow-up) * intervention (prebiotic) * stim_type (plants)</b>	<b>-0.24**</b>	<b>0.16</b>	<b>-1.49</b>
<b>time (follow-up) * intervention (prebiotic) * stim_type (objects)</b>	<b>0.13**</b>	<b>0.12</b>	<b>1.10</b>

Formula: wanting ~ timepoint \* intervention \* stim\_type + timepoint \* stim\_type + timepoint \* intervention + stim\_type \* intervention + timepoint + stim\_type + intervention + (1+(timepoint+intervention)|subject). REML criterion at convergence: 121445,  $n_{obs} = 32,111$ , groups:  $n_{subj} = 59$ . Significance, \*\*  $p < 0.01$

Note: No random slope "stimulus type \* timepoint \* intervention" as model didn't converge -> random slopes "timepoint \* intervention" but random effects too small (error: isSingular) -> random slopes therefore chosen as "timepoint + intervention".

## Model 2: Impact of hunger on intervention effect

SI-Table 9: Mixed effects linear model results on the subjective wanting for post-intervention by stimulus category dependent on hunger rating.

random effects	variance	SD	
subject (intercept)	1.45	0.70	
time (follow-up)	0.04	0.21	
intervention (prebiotic)	0.14	0.37	
mean hunger rating	0.04	0.20	
residual	2.64	1.62	
fixed effects	estimate	SE	t-value
(intercept)	3.07	0.22	13.82
time (follow-up)	-0.54	0.15	-3.72
intervention (prebiotic)	-0.25	0.17	-1.45
stim_category (food)	0.48	0.10	4.58
mean hunger rating	-0.08	0.04	-1.96
time (follow-up) * intervention (prebiotic)	0.56	0.18	3.07
time (follow-up) * stim_category (food)	-0.10	0.15	-0.67
intervention (prebiotic) * stim_category (food)	-0.19	0.15	-1.26
time (follow-up) * mean hunger rating	0.13	0.02	4.04
intervention (prebiotic) * mean hunger rating	0.08	0.03	2.29
stim_category (food) * mean hunger rating	0.12	0.02	5.44
time (follow-up) * intervention (prebiotic) * stim_category (food)	0.03	0.22	0.13
time (follow-up) * intervention (prebiotic) * mean hunger rating	-0.17	0.04	-4.43
time (follow-up) * stim_category (food) * mean hunger rating	0.00	0.03	0.06

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intervention (prebiotic) * stim_category (food) * mean hunger rating	0.04	0.03	1.25
time (follow-up) * intervention (prebiotic) * stim_category (food) * mean hunger rating	0.02	0.05	0.40

Formula: wanting ~ timepoint \* intervention \* stim\_category \* hunger\_mean\_wanting + intervention \* stim\_category \* hunger\_mean\_wanting + timepoint \* stim\_category \* hunger\_mean\_wanting + timepoint \* intervention \* hunger\_mean\_wanting + timepoint \* intervention \* stim\_category + timepoint \* intervention + timepoint \* stim\_category + timepoint \* hunger\_mean\_wanting + stim\_category \* intervention + intervention \* hunger\_mean\_wanting + stim\_category \* hunger\_mean\_wanting + imepoint + stim\_category + intervention + hunger\_mean\_wanting + (1 + (timepoint + intervention + hunger\_mean\_wanting) | subject). REML criterion at convergence: 122827, n<sub>obs</sub> = 32,110, groups: n<sub>subj</sub> = 59. Significance, p=0.69

Note: No random slope "stimulus category \* time \* intervention \* hunger" as random effects too small (error: isSingular) -> random slopes "time \* intervention \* hunger" or "stimulus category + time + intervention + hunger" model did not converge -> random slopes "time + intervention + hunger"

## H\_behav\_3/B: Nutrient content effect on wanting (food only)

H\_behav\_B1: Individual food wanting is not different for kcal\_100g content after a two-week high-fiber intervention across all food stimuli (null model comparison p = 0.85).

## SI-Table 10: Mixed effects linear model results on the subjective wanting for post-intervention dependent on caloric content (kcal / 100g).

random effects	variance	SD	
subject (intercept)	0.85	0.92	
time (follow-up)	0.12	0.35	
intervention (prebiotic)	0.18	0.43	
residual	2.70	1.64	
fixed effects	estimate	SE	t-value
(intercept)	3.85	0.13	29.71
time (follow-up)	-5.63*10 <sup>-2</sup>	0.08	-0.70
intervention (prebiotic)	6.43*10 <sup>-2</sup>	0.08	0.77
kcal_100g	-3.48*10 <sup>-4</sup>	1.45*10 <sup>-4</sup>	-2.40
session (session 2, 3, 4)	-7.01*10 <sup>-2</sup>	0.05	-1.42
time (follow-up) * intervention (prebiotic)	-6.63*10 <sup>-2</sup>	0.08	-0.76
time (follow-up) * kcal_100g	-5.61*10 <sup>-5</sup>	2.08*10 <sup>-4</sup>	-0.27
intervention (prebiotic) * kcal_100g	1.91*10 <sup>-4</sup>	2.02*10 <sup>-4</sup>	0.94
time (follow-up) * intervention (prebiotic) * kcal_100g	-5.55*10 <sup>-5</sup>	2.95*10 <sup>-4</sup>	-0.19

Formula: wanting ~ timepoint \* intervention \* kcal\_100g + intervention \* kcal\_100g + timepoint \* kcal\_100g + timepoint \* intervention + intervention + timepoint + kcal\_100g + (1 + (intervention + timepoint) | subject) + session\_1\_2, data: data\_F\_only). REML criterion at convergence: 62061, n<sub>obs</sub> = 16,071, groups: n<sub>subj</sub> = 59.

H\_behav\_B2: Individual food wanting is not different for fiber\_100g content after a two-week high-fiber intervention across all food stimuli (null model comparison p = 0.32).

## SI-Table 11: Mixed effects linear model results on the subjective wanting for post-intervention dependent on fiber content (fiber / 100g).

random effects	variance	SD	
subject (intercept)	0.85	0.92	
time (follow-up)	0.12	0.35	

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intervention (prebiotic)	0.18	0.43	
residual	2.70	1.64	
<b>fixed effects</b>	<b>estimate</b>	<b>SE</b>	<b>t-value</b>
(intercept)	3.91	0.13	30.54
time (follow-up)	-0.08	0.08	-1.00
intervention (prebiotic)	0.07	0.08	0.85
fiber_100g	-0.07	0.01	-5.45
session (session 2, 3, 4)	-0.07	0.05	-1.45
time (follow-up) * intervention (prebiotic)	-0.03	0.08	-0.30
time (follow-up) * fiber_100g	0.005	0.02	0.29
intervention (prebiotic) * fiber_100g	0.02	0.02	1.08
time (follow-up) * intervention (prebiotic) * fiber_100g	-0.02	0.03	-0.99

Formula: wanting ~ timepoint \* intervention \* fiber\_100g + intervention \* fiber\_100g + timepoint \* fiber\_100g + timepoint \* intervention + intervention + timepoint + fiber\_100g + session\_1\_2 + (1 + (intervention + timepoint) | subject), data: data\_F\_only). REML criterion at convergence: 61946, n<sub>obs</sub> = 16,071, groups: n<sub>subj</sub> = 59. Significance, \*\*\* p < 0.001.

**Model C: Liking as a potential confounding variable on wanting ratings**

Test if subjective liking is a confounding variable for subjective wanting. Note that less datapoints could be included due to incomplete liking ratings.

**SI-Table 12: Mixed effects linear model results on the subjective wanting for post-intervention dependent on subjective liking ratings.**

<b>random effects</b>	<b>variance</b>	<b>SD</b>	
subject (intercept)	0.35	0.60	
time (follow-up)	0.08	0.28	
intervention (prebiotic)	0.13	0.36	
stim_category (food)	0.75	0.87	
residual	1.71	1.31	
<b>fixed effects</b>	<b>estimate</b>	<b>SE</b>	<b>t-value</b>
(intercept)	1.14	0.09	12.27
time (follow-up)	-0.04	0.05	-0.79
intervention (prebiotic)	0.07	0.06	1.07
stim_category (food)	0.09	0.13	0.70
<b>liking</b>	<b>0.50***</b>	<b>0.005</b>	<b>103.22</b>
time (follow-up) * intervention (prebiotic)	-0.13	0.05	-2.81
time (follow-up) * stim_category (food)	-0.09	0.05	-2.03
intervention (prebiotic) * stim_category (food)	0.02	0.05	0.41
time (follow-up) * intervention (prebiotic) * stim_category (food)	0.04	0.06	0.70

Formula: wanting ~ timepoint \* intervention \* stim\_category + timepoint \* stim\_category + timepoint \* intervention + stim\_category \* intervention + liking + timepoint + stim\_category + intervention + (1 + (stim\_category + timepoint + intervention + stim\_category) | subject), (data = data\_liking\_only). REML criterion at convergence: 96357, n<sub>obs</sub> = 27,445, groups: n<sub>subj</sub> = 45. Significance, \*\*\* p < 0.001.

Note: No random slope "stimulus category \* timepoint \* intervention" as model wouldn't converge -> only random slopes "stimulus category + timepoint + intervention"

Interpretation: Yes, subjective liking has a significant positive impact on wanting ratings (p < 0.001).

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## Effects of subjective hunger

Wanting ratings for food were significantly higher, when subjective hunger was higher ( $b = 0.05 \pm 0.02$ ,  $t = 2.38$ ,  $p < 0.05$ , **SI\_behav Table 6**). Individuals' subjective hunger ratings during fMRI sessions were diverse and significantly lower after prebiotic intervention compared to placebo (interaction  $b = -0.39$ ,  $t = -39.65$ ; null model comparison  $p < 0.001$ , **SI\_behav Table 18-19**).

**SI-Table 18: Subjective hunger ratings by timepoint for each intervention arm.** Ratings were measured using a Likert scale inside MR scanner at 10 and 40 min after 10% energy intake using a breakfast shake, with a scale from 1 (not at all) to 8 (extremely).

Timepoint t	Intervention	n	hunger rating			
			10 min postprandial	40 min postprandial	mean 10-40 min postprandial	
			mean $\pm$ SD	mean $\pm$ SD	mean	SD
BL	prebiotics	55	4.25 $\pm$ 1.76	5.16 $\pm$ 1.71	4.71 $\pm$ 1.66	-
FU	prebiotics	48	4.13 $\pm$ 1.66	4.72 $\pm$ 1.73	4.43 $\pm$ 1.60	-0.28 $\pm$ 1.32
BL	placebo	53	3.77 $\pm$ 1.69	4.79 $\pm$ 1.65	4.28 $\pm$ 1.58	-
FU	placebo	49	3.92 $\pm$ 1.68	4.67 $\pm$ 1.72	4.30 $\pm$ 1.54	0.05 $\pm$ 1.37

**SI-Table 19: Mixed effects linear model results on the effects of prebiotic intervention on subjective hunger ratings (average).** Ratings were measured using a Likert scale inside MR scanner at 10 and 40 min after 10% energy intake and averaged, with a scale from 1 (not at all) to 8 (extremely). Model comparison,  $p < 0.001$ .

random effects	variance	SD	
subject (intercept)	2.33	1.53	
time (follow-up)	1.08	1.04	
intervention (prebiotic)	1.12	1.06	
residual	0.18	0.42	
fixed effects	estimate	SE	t-value
(intercept)	4.03	0.83	4.86
time (follow-up)	0.10	0.15	0.67
intervention (prebiotic)	0.46	0.15	3.07
age	0.02	0.03	0.52
gender (male)	-0.27	0.41	-0.66
<b>time (follow-up) * intervention (prebiotic)</b>	<b>-0.39***</b>	<b>0.28***</b>	<b>-39.65***</b>

**Formula:**  $\text{hunger} \sim \text{timepoint} * \text{intervention} + \text{age} + \text{gender} + (1 + (\text{timepoint} + \text{intervention}) | \text{subject})$ . **REML** criterion at convergence: 37696, Number of observations: 204, groups: participants, 59. Significance, \*\*\*  $p < 0.001$

No random slope "timepoint \* intervention" as model did not converge -> only random slopes "timepoint" and "intervention".

## Additional wanting models with "true wanting" models considering weighted ratings.

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Deviant to the preregistration, we did not further explore interaction effects for wanting ratings modelled as dependent outcome variable in three different ways (1, individual wanting – individual liking; 2, individual wanting - individual liking - population mean of wanting; 3 individual wanting \* population mean of wanting) per item, to simplify results.

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