Development and Content Evaluation of the Eating Behavior and Appetite Questionnaire (EBAQ) for Individuals with Obesity

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SUPPLEMENTAL APPENDIX

Targeted Literature Review

The targeted literature review focused on identifying patient-reported outcome instruments used to assess appetite and eating behavior in adults with obesity. Studies in adults (≥18 years) receiving an intervention for obesity or overweight and published in English, such as clinical trials and interventional studies (medication or drug, diets, weight loss programs, behavior-based therapy studies), were included in the analyses. The following kinds of studies were excluded: studies in pediatric populations (≤17 years); studies in adults with type 1 or type 2 diabetes; studies including pregnant females; studies not addressing appetite or eating behaviors; and studies in animals.

The targeted literature review identified 404 abstracts. After screening, 32 articles containing relevant information were shortlisted. From the 32 articles, a total of 23 existing patient-reported outcome instruments were evaluated (Table S1).

Clinician Interviews

Interviews were conducted with clinicians specializing in obesity medicine (N=3) in November 2023 to gain insights on the relevance of the appetite and eating behavior concepts identified from the exit interviews and targeted literature review. The clinicians were US-based physicians with >5 years of experience in treating patients with obesity or overweight. Clinician interviews (45–60 minutes) were conducted via telephone/MS Teams in English using a semi-structured interview guide by an interviewer trained in qualitative research methods. The clinicians were asked questions regarding the changes in appetite and eating behavior reported by patients receiving OMMs. The clinicians also suggested revisions to improve the content, clarity, and cohesion of concepts in the Eating Behavior and Appetite Questionnaire.

Table S1. Eating behavior concepts evaluated in exit interviews and selected PRO measures identified in the TLR

PRO measure identified in the TLR	Number of eating behavior concepts from exit interviews that were also included in the PRO measure[a]	PRO measure included eating behavior concepts not identified in exit interviews
1. Three-Factor Eating Questionnaire (TFEQ/TFEQ-R21)	10/19	Yes
2. Food Cravings Questionnaire (FCQ)	8/19	Yes
3. Yale Food Addiction Scale (YFAS)	8/19	Yes
4. Adult Eating Behaviour Questionnaire (AEBQ)	8/19	Yes
5. Control of Eating Questionnaire (CoEQ)	6/19	Yes
6. Council of Nutrition Appetite Questionnaire (CNAQ)	6/19	No
7. The Pardo Questionnaire	6/19	No
8. Intuitive Eating Score (IES)	6/19	Yes
9. Mindful Eating Questionnaire (MEQ)	5/19	Yes
10. Dutch Eating Behavior Questionnaire (DEBQ)	4/19	Yes
11. esSatter Inventory 2.0	4/19	No
12. Eating Behavior PRO[b] (EB PRO)	4/19	No
13. Food Frequency Questionnaire (FCI)	3/19	No
14. Leeds Food Preference Questionnaire (LFPQ)	3/19	No
15. Weight-Related Eating Questionnaire (WREQ)	3/19	Yes
16. Block Food Frequency Questionnaire (FFQ)	3/19	No
17. Finnish Health and Taste Attitude Scales (HTAS)	3/19	No
18. Eating Behavior Inventory (EBI)	2/19	No
19. Automated Self-Administration 24-Hour Dietary Assessment Tool (ASA-24)	1/19	No
20. Healthy Eating Index (HEI)	1/19	No
21. Weight Control Strategies Scale (WCSS)	1/19	No
22. The Body Shape Questionnaire-8C (BSQ-8C)	1/19	No
23. Food Cravings Test	1/19	No

PRO patient-reported outcome, *TLR* targeted literature review

[a] Exit interviews were conducted with 40 participants with obesity (body mass index: ≥30 kg/m^2) or with overweight (body mass index: ≥27 kg/m^2) in the phase 2 trial of retatrutide vs placebo (NCT04881760) [1]. These interviews probed 16 appetite and eating behavior concepts in the treatment of obesity. Three additional concepts were spontaneously mentioned by some participants.

[b] This PRO measure was not identified in the TLR search but was included in the analyses as a PRO measure of interest.

Table S2. Clinician interviews (N=3)

	Concept elicitation	EBAQ review (Draft 1 with 23 items)	
	Key aspects of appetite or eating behaviors likely to be impacted by OMMs (N=3)	A little bit important/ Somewhat important (N=3)	Important/Very important (N=3)
Hunger and satiety	3	---	3
Food frequency and amount	1	---	3
Cravings	2	---	3
Food choices and preferences	3	---	3
Cognitive restraint or eating control	1	---	3
Thoughts and physical sensations during and after eating	1	2	1
Emotional and comfort eating	1	--	3
Boredom eating	---	1	2
Lifestyle	---	---	3
Social eating	---	---	3
External cues	1	---	3

EBAQ eating behavior and appetite questionnaire, *OMM* obesity management medication

Table S3. Additional sociodemographic and health characteristics of participants

	No OMM (N=16)	OMM (N=7)[a]	Total (N=23)[a]
Education, n (%)			
Secondary/High School	3 (18.8)	2 (28.6)	5 (21.7)
Associate degree/technical/trade school	3 (18.8)	1 (14.3)	4 (17.4)
Some college	6 (37.5)	1 (14.3)	7 (30.4)
College/university degree (BA, BS)	4 (25.0)	3 (42.9)	7 (30.4)
Employment status, n (%)			
Employed (full-time)	9 (56.3)	6 (85.7)	15 (65.2)
Retired	1 (6.3)	1 (14.3)	2 (8.7)
Homemaker	2 (12.5)	0 (0.0)	2 (8.7)
Student	1 (6.3)	0 (0.0)	1 (4.3)
Unemployed	3 (18.8)	0 (0.0)	3 (13.0)
Overall health in the past week, n (%)			
Excellent	1 (6.3)	1 (14.3)	2 (8.7)
Very good	3 (18.8)	3 (42.9)	6 (26.1)
Good	6 (37.5)	3 (42.9)	9 (39.1)
Fair	6 (37.5)	0 (0.0)	6 (26.1)
Past or current health conditions[b] n (%)			
Obesity-related complications			
Anxiety	7 (43.8)	0 (0.0)	7 (30.4)
Arthritis	4 (25.0)	1 (14.3)	5 (21.7)
Cancer	2 (12.5)	0 (0.0)	2 (8.7)
Depression	4 (25.0)	0 (0.0)	4 (17.4)
Type 2 diabetes	2 (12.5)	2 (28.6)	4 (17.4)
Heart disease or heart attack	0 (0.0)	1 (14.3)	1 (4.3)
Hypertension or high blood pressure	8 (50.0)	1 (14.3)	9 (39.1)
Sleep apnea	3 (18.8)	1 (14.3)	4 (17.4)
High cholesterol	3 (18.8)	0 (0.0)	3 (13.0)
Fatty liver disease	2 (12.5)	1 (14.3)	3 (13.0)
Other conditions			
Substance use disorder	1 (6.3)	0 (0.0)	1 (4.3)
Other mental health conditions:	1 (6.3)	0 (0.0)	1 (4.3)
Other health conditions:	3 (18.8)	2 (28.6)	5 (21.7)
None	2 (12.5)	2 (28.6)	4 (17.4)

OMM obesity management medication

[a] One participant did not return their sociodemographic form.

[b] Responses are not mutually exclusive.

Table S4. Participants' responses to the EQ-5D-5L

	EQ-5D-5L (N=23)[a]				
	Mobility	**Self-Care**	**Usual Activities**	**Pain/ Discomfort**	**Anxiety/ Depression**
Responses, n (%)					
No problems[b]	19 (82.6)	22 (95.7)	18 (78.3)	12 (52.2)	13 (56.5)
Slight problems	3 (13.0)	1 (4.3)	3 (13.0)	6 (26.1)	6 (26.1)
Moderate problems	1 (4.3)	0 (0.0)	2 (8.7)	4 (17.4)	4 (17.4)
Severe problems	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Extreme problems/Unable	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Missing	-	-	-	1 (4.3)	-
EQ-5D VAS Score, mean (SD)			79.0 (13.3)		
EQ-5D Index Score, mean (SD)[c]			0.9 (0.1)		

SD standard deviation, *VAS* visual analog scale

Participants rated each dimension of the EQ-5D-5L on a scale of 1–5. A higher score for a dimension indicated a worse status for that dimension (where 1="no problems" and 5="severe problems/unable").

Participants rated their current health status EQ-VAS on a scale of 0–100. A higher score indicated a better health state (where 0="worst imaginable health state" and 100="best imaginable health state").

[a] One participant did not return the questionnaire.

[b] Values indicate potential floor effects (i.e., ≥25% of participants responded "No problems").

[c] Index scores range from −0.59 to 1 (where 1="best possible health state").

Table S5. Participants' responses to the FCQ-T-r questionnaire

Item No.	Item	FCQ-T-r Response Frequencies and Percentages (N=23)[a]					
		Never n (%)	Rarely n (%)	Sometimes n (%)	Often n (%)	Usually n (%)	Always n (%)
1	When I crave something, I know I won't be able to stop eating once I start.	6 (26.1)[b]	5 (21.7)	9 (39.1)	1 (4.3)	2 (8.7)	0 (0.0)
2	If I eat what I am craving, I often lose control and eat too much.	5 (21.7)	8 (34.8)	7 (30.4)	2 (8.7)	1 (4.3)	0 (0.0)
3	Food cravings invariably make me think of ways to get what I want to eat.	3 (13.0)	7 (30.4)	7 (30.4)	5 (21.7)	1 (4.3)	0 (0.0)
4	I feel like I have food on my mind all the time.	6 (26.1)[b]	10 (43.5)	4 (17.4)	3 (13.0)	0 (0.0)	0 (0.0)
5	I find myself preoccupied with food.	7 (30.4)[b]	11 (47.8)	2 (8.7)	3 (13.0)	0 (0.0)	0 (0.0)
6	Whenever I have cravings, I find myself making plans to eat.	1 (4.3)	5 (21.7)	12 (52.2)	4 (17.4)	1 (4.3)	0 (0.0)
7	I crave foods when I feel bored, angry, or sad.	7 (30.4)[b]	5 (21.7)	3 (13.0)	1 (4.3)	5 (21.7)	2 (8.7)
8	I have no will power to resist my food crave.	7 (30.4)[b]	6 (26.1)	5 (21.7)	4 (17.4)	1 (4.3)	0 (0.0)
9	Once I start eating, I have trouble stopping.	9 (39.1)[b]	6 (26.1)	6 (26.1)	2 (8.7)	0 (0.0)	0 (0.0)
10	I can't stop thinking about eating no matter how hard I try.	12 (52.2)[b]	6 (26.1)	1 (4.3)	3 (13.0)	1 (4.3)	0 (0.0)
11	If I give in to a food craving, all control is lost.	10 (43.5)[b]	6 (26.1)	5 (21.7)	2 (8.7)	0 (0.0)	0 (0.0)
12	Whenever I have a food craving, I keep on thinking about eating until I actually eat the food.	6 (26.1)[b]	6 (26.1)	4 (17.4)	4 (17.4)	3 (13.0)	0 (0.0)
13	If I am craving something, thoughts of eating it consume me.	11 (47.8)[b]	6 (26.1)	3 (13.0)	2 (8.7)	1 (4.3)	0 (0.0)
14	My emotions often make me want to eat.	3 (13.0)	7 (30.4)	6 (26.1)	4 (17.4)	3 (13.0)	0 (0.0)
15	It is hard for me to resist the temptation to eat appetizing foods that are in my reach.	6 (26.1)[b]	4 (17.4)	8 (34.8)	3 (13.0)	2 (8.7)	0 (0.0)
FCQ-T-r Total Score, mean (SD, range)		36.1 (14.2, 18.0-64.0)					

FCQ-T-r Food Craving Questionnaire-Trait reduced, *SD* standard deviation

Participants rated how frequently each item is true for them on a 6-point scale ranging from "Never/Not Applicable" to "Always". The total score is the sum of all 15 item scores. Higher scores indicated greater food cravings.

[a] One participant did not return the questionnaire.

[b] Values indicate possible floor effects (i.e., ≥25% of participants responded "Never").

Table S6. EBAQ responses (Draft 2) (N=24)

		Response Frequencies and Percentages [a]				
Item No. Domain and Item Description	**Mean (SD)**	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
Appetite domain						
1. Hunger between meals (N=24)	1.6 (0.9)	1 (4.2)	12 (50.0)	6 (25.0)	5 (20.8)	0 (0.0)
OMMs (N=8)	1.5 (0.8)	0 (0.0)	5 (62.5)	2 (25.0)	1 (12.5)	0 (0.0)
No OMMs (N=16)	1.7 (0.9)	1 (6.3)	7 (43.8)	4 (25.0)	4 (25.0)	0 (0.0)
2. Fullness between meals (N=24)	2.6 (0.8)	0 (0.0)	2 (8.3)	8 (33.3)	11 (45.8)	3 (12.5)
OMMs (N=8)	2.8 (0.9)	0 (0.0)	1 (12.5)	1 (12.5)	5 (62.5)	1 (12.5)
No OMMs (N=16)	2.6 (0.8)	0 (0.0)	1 (6.3)	7 (43.8)	6 (37.5)	2 (12.5)
3. Fullness after eating a small amount of food (N=24)	1.9 (0.9)	1 (4.2)	7 (29.2)	10 (41.7)	5 (20.8)	1 (4.2)
OMMs (N=8)	2.4 (1.2)	1 (12.5)	0 (0.0)	3 (37.5)	3 (37.5)	1 (12.5)
No OMMs (N=16)	1.7 (0.7)	0 (0.0)	7 (43.8)	7 (43.8)	2 (12.5)	0 (0.0)
4. Quickly satisfied while eating (N=24)	2.3 (0.9)	1 (4.2)	3 (12.5)	11 (45.8)	7 (29.2)	2 (8.3)
OMMs (N=8)	2.8 (1.0)	0 (0.0)	1 (12.5)	2 (25.0)	3 (37.5)	2 (25.0) [b]
No OMMs (N=16)	2.0 (0.8)	1 (6.3)	2 (12.5)	9 (56.3)	4 (25.0)	0 (0.0)
5. Eating small portions (N=24)	2.3 (1.0)	0 (0.0)	6 (25.0)	9 (37.5)	6 (25.0)	3 (12.5)
OMMs (N=8)	2.8 (0.9)	0 (0.0)	0 (0.0)	4 (50.0)	2 (25.0)	2 (25.0) [b]
No OMMs (N=16)	2.0 (1.0)	0 (0.0)	6 (37.5)	5 (31.3)	4 (25.0)	1 (6.3)
6. Eating snacks between meals (N=24)	2.5 (1.1)	0 (0.0)	5 (20.8)	6 (25.0)	8 (33.3)	5 (20.8)
OMMs (N=8)	2.5 (1.2)	0 (0.0)	2 (25.0)	2 (25.0)	2 (25.0)	2 (25.0) [b]
No OMMs (N=16)	2.6 (1.0)	0 (0.0)	3 (18.8)	4 (25.0)	6 (37.5)	3 (18.8)
7. Choosing healthy foods (N=24)	2.4 (0.8)	0 (0.0)	3 (12.5)	11 (45.8)	8 (33.3)	2 (8.3)
OMMs (N=8)	2.9 (0.6)	0 (0.0)	0 (0.0)	2 (25.0)	5 (62.5)	1 (12.5)
No OMMs (N=16)	2.1 (0.8)	0 (0.0)	3 (18.8)	9 (56.3)	3 (18.8)	1 (6.3)
8. Preferring healthy foods (N=24)	2.4 (1.0)	1 (4.2)	2 (8.3)	10 (41.7)	8 (33.3)	3 (12.5)
OMMs (N=8)	2.9 (0.6)	0 (0.0)	0 (0.0)	2 (25.0)	5 (62.5)	1 (12.5)
No OMMs (N=16)	2.2 (1.0)	1 (6.3)	2 (12.5)	8 (50.0)	3 (18.8)	2 (12.5)
Eating Control						
9. In control of eating habits (N=24)	2.5 (0.7)	0 (0.0)	1 (4.2)	12 (50.0)	9 (37.5)	2 (8.3)
OMMs (N=8)	2.9 (0.6)	0 (0.0)	0 (0.0)	2 (25.0)	5 (62.5)	1 (12.5)
No OMMs (N=16)	2.3 (0.7)	0 (0.0)	1 (6.3)	10 (62.5)	4 (25.0)	1 (6.3)
10. Appetite was controlled (N=24)	2.3 (0.9)	1 (4.2)	2 (8.3)	11 (45.8)	9 (37.5)	1 (4.2)
OMMs (N=8)	2.6 (1.2)	1 (12.5)	0 (0.0)	1 (12.5)	5 (62.5)	1 (12.5)
No OMMs (N=16)	2.1 (0.6)	0 (0.0)	2 (12.5)	10 (62.5)	4 (25.0)	0 (0.0)
11. Resist eating between meals when food was available (N=24)	1.9 (1.0)	1 (4.2)	8 (33.3)	8 (33.3)	6 (25.0)	1 (4.2)
OMMs (N=8)	2.3 (1.0)	0 (0.0)	2 (25.0)	3 (37.5)	2 (25.0)	1 (12.5)
No OMMs (N=16)	1.8 (0.9)	1 (6.3)	6 (37.5)	5 (31.3)	4 (25.0)	0 (0.0)
12. Eating when not hungry (N=24)	1.8 (1.0)	2 (8.3)	7 (29.2)	9 (37.5)	5 (20.8)	1 (4.2)
OMMs (N=8)	1.9 (1.4)	1 (12.5)	3 (37.5)	1 (12.5)	2 (25.0)	1 (12.5)
No OMMs (N=16)	1.8 (0.8)	1 (6.3)	4 (25.0)	8 (50.0)	3 (18.8)	0 (0.0)
13. Eating in response to thoughts about food (N=24)	1.8 (1.1)	4 (16.7)	4 (16.7)	10 (41.7)	5 (20.8)	1 (4.2)

OMMs (N=8)	1.1 (0.8)	2 (25.0) [b]	3 (37.5)	3 (37.5)	0 (0.0)	0 (0.0)
No OMMs (N=16)	2.1 (1.1)	2 (12.5)	1 (6.3)	7 (43.8)	5 (31.3)	1 (6.3)
14. Thinking about eating (N=24)	1.4 (1.0)	5 (20.8)	7 (29.2)	9 (37.5)	3 (12.5)	0 (0.0)
OMMs (N=8)	0.8 (0.7)	3 (37.5) [b]	4 (50.0)	1 (12.5)	0 (0.0)	0 (0.0)
No OMMs (N=16)	1.8 (0.9)	2 (12.5)	3 (18.8)	8 (50.0)	3 (18.8)	0 (0.0)
15. Guilt after eating (N=24)	1.5 (1.0)	5 (20.8)	7 (29.2)	8 (33.3)	4 (16.7)	0 (0.0)
OMMs (N=8)	1.1 (1.1)	3 (37.5) [b]	2 (25.0)	2 (25.0)	1 (12.5)	0 (0.0)
No OMMs (N=16)	1.6 (1.0)	2 (12.5)	5 (31.3)	6 (37.5)	3 (18.8)	0 (0.0)
Triggers						
16. Cravings for sweet or sugary foods (N=24)	2.1 (1.0)	0 (0.0)	8 (33.3)	9 (37.5)	4 (16.7)	3 (12.5)
OMMs (N=8)	1.9 (0.8)	0 (0.0)	3 (37.5)	3 (37.5)	2 (25.0)	0 (0.0)
No OMMs (N=16)	2.2 (1.1)	0 (0.0)	5 (31.3)	6 (37.5)	2 (12.5)	3 (18.8)
17. Cravings for fatty or fried foods (N=24)	1.8 (1.0)	2 (8.3)	6 (25.0)	11 (45.8)	4 (16.7)	1 (4.2)
OMMs (N=8)	1.8 (0.7)	0 (0.0)	3 (37.5)	4 (50.0)	1 (12.5)	0 (0.0)
No OMMs (N=16)	1.9 (1.1)	2 (12.5)	3 (18.8)	7 (43.8)	3 (18.8)	1 (6.3)
18. Cravings for specific foods (N=24)	2.2 (0.8)	0 (0.0)	4 (16.7)	13 (54.2)	6 (25.0)	1 (4.2)
OMMs (N=8)	1.9 (0.6)	0 (0.0)	2 (25.0)	5 (62.5)	1 (12.5)	0 (0.0)
No OMMs (N=16)	4.3 (0.8)	0 (0.0)	2 (12.5)	8 (50.0)	5 (31.3)	1 (6.3)
19. Cravings for healthy foods (N=24)	2.3 (0.8)	0 (0.0)	4 (16.7)	11 (45.8)	8 (33.3)	1 (4.2)
OMMs (N=8)	2.4 (0.5)	0 (0.0)	0 (0.0)	5 (62.5)	3 (37.5)	0 (0.0)
No OMMs (N=16)	2.2 (0.9)	0 (0.0)	4 (25.0)	6 (37.5)	5 (31.3)	1 (6.3)
20. Eating because of emotions (N=24)	1.8 (1.1)	2 (8.3)	9 (37.5)	7 (29.2)	4 (16.7)	2 (8.3)
OMMs (N=8)	1.6 (1.1)	0 (0.0)	5 (62.5)	2 (25.0)	0 (0.0)	1 (12.5)
No OMMs (N=16)	1.9 (1.1)	2 (12.5)	4 (25.0)	5 (31.3)	4 (25.0)	1 (6.3)
21. Needing food as comfort (N=24)	1.2 (1.1)	8 (33.3)	6 (25.0)	7 (29.2)	3 (12.5)	0 (0.0)
OMMs (N=8)	1.1 (0.8)	2 (25.0) [b]	3 (37.5)	3 (37.5)	0 (0.0)	0 (0.0)
No OMMs (N=16)	1.3 (1.2)	6 (37.5)	3 (18.8)	4 (25.0)	3 (18.8)	0 (0.0)
22. Eating when bored (N=24)	1.8 (1.2)	4 (16.7)	6 (25.0)	8 (33.3)	4 (16.7)	2 (8.3)
OMMs (N=8)	1.1 (1.4)	3 (37.5) [b]	3 (37.5)	1 (12.5)	0 (0.0)	1 (12.5)
No OMMs (N=16)	2.1 (1.0)	1 (6.3)	3 (18.8)	7 (43.8)	4 (25.0)	1 (6.3)
23. Eating because stressed (N=24)	1.6 (1.2)	4 (16.7)	9 (37.5)	6 (25.0)	3 (12.5)	2 (8.3)
OMMs (N=8)	1.4 (1.3)	2 (25.0) [b]	3 (37.5)	2 (25.0)	0 (0.0)	1 (12.5)
No OMMs (N=16)	1.7 (1.1)	2 (12.5)	6 (37.5)	4 (25.0)	3 (18.8)	1 (6.3)

EBAQ Eating Behavior and Appetite Questionnaire; OMM, obesity management medication; SD, standard deviation

[a] Participants were asked to select responses for each item that best described their experience in the previous 7 days using a 5-point scale ranging from "Never" to "Always". Responses were assigned scores: 0="Never", 1="Rarely", 2="Sometimes", 3="Often", 4 ="Always".

[b] Values indicate possible floor or ceiling effects (≥25% of participants responded "never" or "always," respectively).

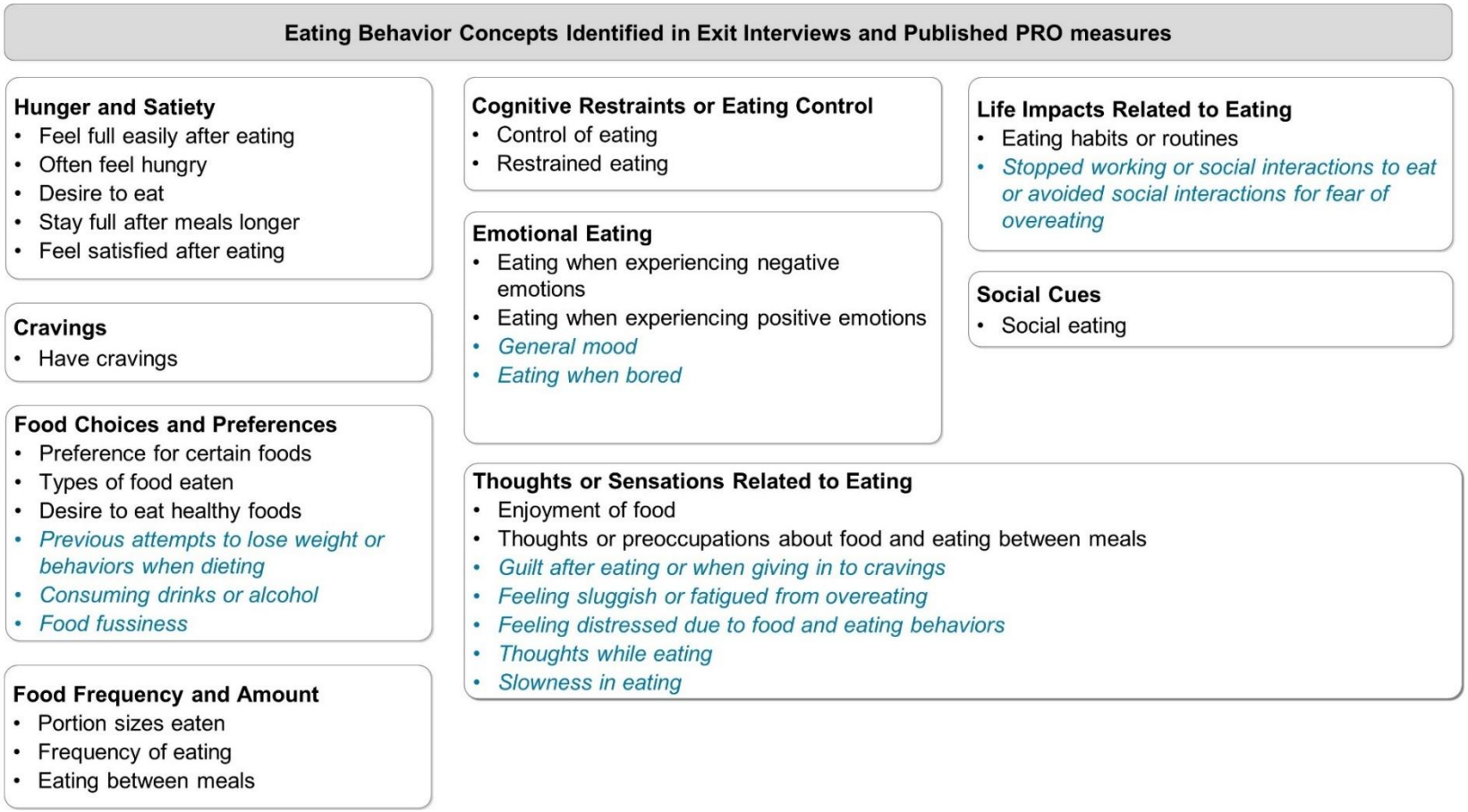

Fig. S1. Thematic map of appetite and eating behavior concepts identified from exit interviews and published PRO measures in the TLR

Black text indicates appetite and eating behavior concepts that emerged during exit interviews with participants (N=40) from the phase 2 clinical trial of retatrutide vs placebo (NCT04881760). Italicized blue text indicates eating behavior concepts included in published PRO measures (N=23) identified in the TLR (see also Table S1). *PRO* patient-reported outcomes, *TLR* targeted literature review.

1. Goetz I, Boye K, Kanu C, Jimenez-Moreno C, Karn H, Kimel M, Neff LM. Perceived benefits of retatrutide for people with obesity: A qualitative study of phase 2 trial participants. Obesity Week. San Antonio, Texas: Obesity (Silver Spring); 2024. p. 61.