

The Cognition of Hunger and Eating Behaviours

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Abstract

Hunger is a poorly defined cognition, assumed to motivate overeating, but there is no firm evidence that the intensity of a sense of hunger is related to overweight. Recent research has suggested instead that irregular eating habits, as deriving from dieting, emotional stressors or other causes may have a role in the weight gain of obese people. These "borderline eating behaviours" (or BEB), targeted in cognitive behavioural therapy of obesity, were found associated to the body mass index both in normal and in overweight subjects in previous studies, using a specific scale called SENICAL. This study aimed at exploring the role of the sense of "unbearable hunger" on these eating irregularities, as measured with SENICAL, which provides an overall measure of BEB. SENICAL has been administered to a sample of 365 university students, together with other self-report measures; one item of SENICAL has been used to measure the frequency of the feeling of "unbearable hunger". An ANCOVA performed on the total SENICAL scores showed a linear increase of BEB along with the frequency of perceived "unbearable hunger", independently from age and gender. An item analysis of the SENICAL scale, performed with Chi square, showed that 15 out of 27 of these behavioural and emotional responses comprising the scale were associated with the sense of hunger, such as to diet or try to fast, to eat at irregular times, to eat more than usual when in emotional state, to eat quickly and not to taste the food, and to worry about weight increase. The "sense of hunger" may contribute to disrupt the eating habits, and maintain many of the eating irregularities associated to weight gain called "borderline eating behaviours". These results suggest that the cognition of hunger is worth to be targeted in the treatment of obese people.

Keywords: eating behaviour, hunger, cognition, cognitive-behaviour therapy

The Problem of Hunger

"Hunger" is a term colloquially used to refer to appetite, or other bodily sensations usually associated to fasting, and assumed to motivate eating. Both appetite and hunger refer to internal signals preceding eating behaviours, but while appetite is usually, a sensation rated as pleasant, as an expectation to fulfil a desire, hunger is perceived as a cause of suffering. Appetite is also socially perceived as positive: parents may be glad to notice the signs of appetite in their children, but they may not accept to let them "suffer" from hunger. The two apparently akin concepts, then, have marked differences in meanings and emotional tones attached. The importance of these differences seems to be poorly understood in clinical work and underestimated in research studies. Given the prevalent use of the term hunger instead of appetite, not only in common language but even in research studies, it is interesting to examine what the problems are with the use of the term "hunger" both in clinical and research work.

First, it could be useful to give a closer scrutiny to the different meanings that the term "hunger" has in different disciplines. There may be no better way to understand the meaning of a term than to observe its use. In the clinical assessment of obese or overweight patients, as well as in other studies on humans (such as drug studies tapping this dimension), hunger is appraised as a subjective variable; as such, it is usually measured not by direct observation, but with self-reports by patients (or study subjects) using analogue scales or Likert-type questionnaires. In fact, the use of eating behaviour as a measure of hunger would be highly questionable, given the motivational and subjective nature of this variable.

Conversely, in animal experimental studies, hunger is operationally but somewhat arbitrarily measured with the time lapsed from the last feeding of the animals. Common implicit assumption in these studies is that the longer is the time gap since the last meal, the stronger is hunger. Sometimes, "hungry" animals are those, which have not been fed once in the habitual feeding time in the laboratory, and so have skipped one meal; in other studies, "hungry" animals are those kept at a reduced food supply to the point of weight loss. This should bring some caution in the use of information derived from animal studies in dealing with hunger in humans.

In economic science, hunger is conceptualised as an effect of famine, the food shortage or the reduced access to food resources for a population or a human group. Hunger has been a ghost in most of the millennial history and even more likely in the long pre-history of humankind. In our Western culture, Famine has horrified the life of humans perhaps since its beginning, together with Plague, Death and War, (the "Apocalypse Knights"); to the point that all human cultures can be viewed as a whole set of beliefs and practices developed to keep hunger at bay and avoid its dire consequences. This imprinting has left many traces even today, in our societies where food is largely available: "hunger" is a term still loaded with negative

semantics¹, since it represents an "ugly" condition, a shame for the whole society, a danger to be avoided at any cost. Thus, no wonder that the term "hunger" has been loaded with intense negative emotions.

It is important to note that many if not all the different meanings not only are implicitly entangled in common language, and thus in the clinical interviews with patients with weight problems, but have also affected the research literature on the treatment of obesity. So, health professionals as well, relying on this literature and as members of our culture, may risk to use the term hunger to refer to different phenomena, not necessarily linked to its biological roots.

Physiologically, hunger can be defined as a biological signal to make the organism aware of a reduction of energy stores that requires a short term correcting action. Thus, it is a signal of sub-optimal nutritional level, not just a signal of a lowering blood glucose level². It may be worth to note that if we accept this biological definition, then the usual measures of hunger above mentioned are not appropriate: in fact, both human subjects' appraisal (subjective measures) and the time lag since the last meal (arbitrary measure) are not measures of the nutritional level, which can be appraised instead only with clinical or metabolic laboratory parameters.

Cognitive-Behavioural Assessment of Hunger in the Obese

A very general assumption hold in cognitive-behaviour therapy (CBT) is that emotional and behavioural responses are dependent from subjects' cognitions. Therefore, in particular in CBT of obese people, it should be important to examine the cognition of hunger. Albeit obese patients often report a "sense of hunger" which is described as "unbearable" (as a compelling force urging them to look for food and eat it to avoid serious consequences), this belief is rarely challenged in CBT of obese patients. As Matthen (1998) notices: "in humans, some action-relevant states such as fear count as emotions, while others such as hunger ... do not", a neglect we may be unaware of.

However, to assume that the subjective sense of hunger reported by the obese always represents a bodily signal of an urgent need to eat is in contrast both with the clinical experience with the obese, with the laboratory data, with the above mentioned biological definition, and with the approach based on social learning theories.

Obese patients, if carefully questioned, very often can provide examples of personal circumstances in which they have experienced strong "hunger pangs", which however could be eased or even disappeared without eating any food (especially if not available in the occasion) but just following some other distracting

¹ Most of the same comments could be valid in the area of "pain".

² The latter parameter is continuously swinging within physiological limits, and only when it plunges to very low levels then the individual can temporarily experience unpleasant feelings.

activity. Moreover, they are often aware (although this awareness is not always salient) that their "hunger" is associated to emotional tensions of other nature than the lack of food.

Laboratory often provides evidence that no metabolic abnormality exists which can justify this sense of hunger in most of the occasions reported by obese patients. Besides, it is very unlikely that obese patients are in a condition of malnutrition such to produce "unbearable hunger". This may hold either even if some of them may have poor glucose utilisation, because of insulin resistance, or because suffering from transitory hypoglycaemia after administration of hypoglycaemic drugs: homeostatic physiological mechanisms shortly bring back again blood glucose to the needed level.

Experimental psychology has shown since long that eating behaviour can be conditioned (Ferster, Numberger, & Levitt, 1962); this early work provided an experimental evidence base, which prompted Stuart (1967) to start the first behaviour therapies with obese patients. CBT for obesity, a treatment which has been recognised nowadays as the most effective psychosocial intervention in the obese (Shaw, O'Rourke, Del Mar, & Kenardy, 2005), largely originates from cognitive-social learning theories. Conditioning and learning have helped to understand how much of eating behaviour is shaped by the environment, from the learning of family eating habits and choices to cultural beliefs and other influences. It has been shown that visceral responses of appetite can be conditioned as well, given the reinforcing properties of palatable foods. So, no wonder that overeating (or hyperphagia), the tendency to eat in excess of own energy needs, may well have some learned components. Thus, it is legitimate to assume that its subjective counterpart, the "sense of hunger", whatever its biological basis, is also affected by conditioning and learning, albeit it is not open to direct observation. Moreover, the labelling as "hunger" a variety of bodily sensations independent from the nutritional state of the organism was already observed in clinical cases of eating disorders by Bruch (1977), and confirmed by much of subsequent research.

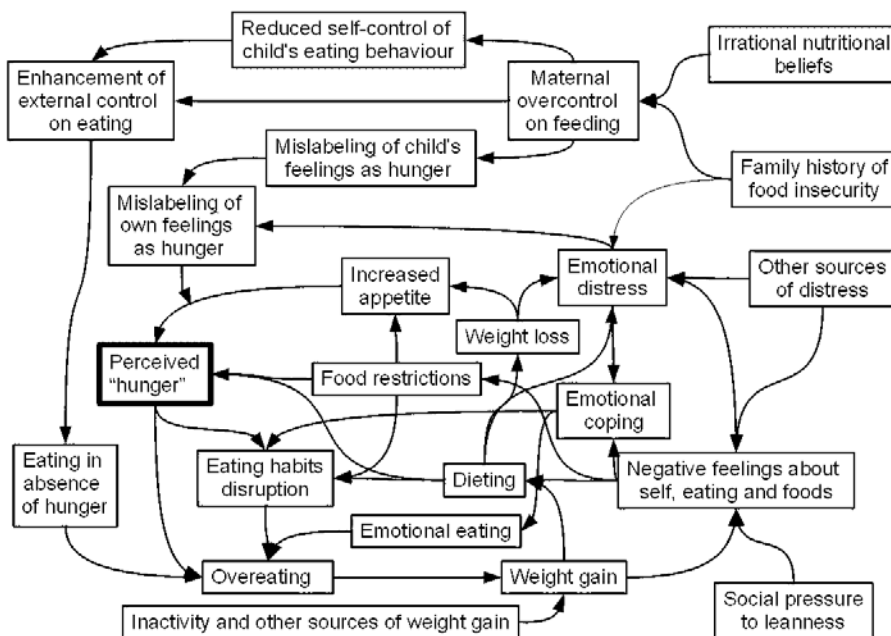
Overeating also resulted associated with other conditions than the "sense of hunger" and emotional tensions: eating in the absence of hunger (EAH), in fact, has been described and studied (Faith et al., 2006) as a different form of hyperphagia, learned by children whose eating has been under over control by mothers (Birch, Fisher, & Krahnstoever Davison, 2003).

Dieting and food restrictions in adolescence have also been found as behaviours predicting eating disorders, in particular bulimia nervosa (Patton, Selzer, Coffey, Carlin, & Wolfe, 1999; Stice, Cameron, Hayward, Barr Taylor, & Killen, 1999). In obese patients, although regular binge eating is not typical, the cycling between dieting and overeating is a frequent finding, producing shifts from weight loss to weight gain and reverse, a behaviour which has been appraised to bring to weight gain in the long run (Bray & Delaney, 1992), as eating habits are disrupted.

Moreover, the condition called "food insecurity" has been much researched recently. This construct has been studied as a social, economic and political problem, which can affect health outcomes independently of socio-economic status and poverty, through its effects on psychological well-being of children (Olson, 1999).

Thus, a web of bio-psychosocial and behavioural pathways and maintenance factors are relevant in the learning of overeating, according with current research findings. The whole picture of the relationships among the sense of hunger and other eating-related variables such as dieting, food restrictions and/or insecurity, distress, disruption of eating habits, and mislabelling of bodily feelings may then be rather complex. The learning history of each individual as well as the entanglement of relevant variables for each case may differ from other cases to the point that a single model cannot account for most of the variance of the dependent measure (BMI). In Figure 1, an example is given of this entanglement in a typical albeit theoretic case of obesity, where the role of the perceived "hunger" is bold.

Figure 1. The web of bio-psychosocial and behavioural pathways and maintenance factors relevant in the learning of overeating



Borderline Eating Behaviours

We have recently reported that a host of irregular eating-related habits and emotional reactions were found linearly associated to body mass index (BMI), either in normal (Sibilia, Abruzzo, & Capezzuto, 2008) and obese population samples (Sibilia, Tridici, & Carro, 2004). These irregular eating-related responses are not abnormal of such degree to gain the psychiatric relevance of symptoms of an eating disorder, such as "binge eating", but nonetheless we have assumed that they may impart a slow but steady weight gain, in particular if very frequent or daily. Therefore, we have proposed to call these habitual responses "*borderline eating behaviours*" (BEB), to underscore their characteristics of being between the normal and abnormal range, since they entail daily inadvertent nutritional excesses and therefore overweight in the long run, but are not serious enough so to be considered psychiatric diagnostic criteria.

BEB have been measured in previous mentioned studies (Sibilia, Abruzzo, & Capezzuto, 2008; Sibilia, Tridici, & Carro, 2004) with a questionnaire built on purpose, the 27-items SENICAL (*Scala degli eccessi nutritivi ineventi e dei comportamenti alimentari limite* - Scale of inadvertent nutritional excesses and borderline eating behaviours). The items comprising the Scale were derived from the cognitive-behavioural clinical analyses of obese patients performed by the author and from the usual targets of effective cognitive-behavioural treatments for weight reduction.

The present study aimed to assess the hypothesis that a higher frequency of the experience of "unbearable hunger" is associated to more frequently disrupt and irregular eating-related habits, which we called "*borderline eating behaviours*", in normal weight people; moreover, it aimed at identifying the specific BEB, which are characteristic of people who report more often the sense of "unbearable hunger".

METHOD

Participants

The sample (Table 1) was composed of 365 students of the Faculty of philosophy of the Sapienza University of Rome, enrolled for a written exam in February 2004. The sample composed of 20 males and 244 females, and further 92 subjects who did not fill the information about gender (26%). Age varied between 18 and 48 years ($M = 22.7$, $SD = 5.43$), 50 subjects (16%) did not provide the information about age.

Table 1. Mean age in males and females and total group

	N	Mean age	SD	Minimum	Maximum
Males	20	24	5.59	19	41
Females	244	22.8	5.58	18	48
Total ³	315	22.7	5.43	18	48

Instruments

In order to study how the sense of "unbearable hunger" may disrupt subjects' eating habits, we have used the SENICAL questionnaire administered to this sample of students as a measure of BEB; moreover, one item (n. 25) of the same instrument was used as a measure of the frequency of the experience of "unbearable hunger". The previous study (Sibilia, Tridici, & Carro, 2004) that examined the psychometric properties of SENICAL had shown satisfactory properties: Pearson's $r = .68$ (odd-pair); Cronbach's $\alpha = .81$. SENICAL total scores therefore provide an overall measure of subjects' eating irregularities, which have been called BEB; these were both theoretically associated to overweight, and empirically correlated to it with a linear gradient (Sibilia, Abruzzo, & Capezzuto, 2008; Sibilia, Tridici, & Carro, 2004).

All response options are given on a four steps Likert scale, asking for the frequency of each eating-related response ("*Never or almost never*", "*Sometimes*", "*Often*", "*Always or almost always*"); they were scored from 1 to 4 if items expressed an instance of BEB, or were reverted (4 to 1) if the items were worded in order to describe alternative responses opposite to BEB, that is, expressed rather regular eating habits; for example, responses to the item "*I always eat at the same time of the day*" were scored from 4 ("*Almost never*") to 1 ("*Almost always*").

To measure the frequency of the experience of "unbearable hunger" the SENICAL item n. 25 has been used ("*At times I feel an unbearable hunger*"). The response options of this item have been also given on a four steps Likert scale, as all other items of the SENICAL scale, and were directly scored from 1 ("*Almost never*") to 4 ("*Almost always*").

Procedure

They were administered collectively, soon after their exam, a battery comprising the SENICAL questionnaire and other self-report scales pertaining to

³ Excluded subjects without data

their lifestyle habits, their bodily measures weight and height, together with their curricular year and university course, and the basic biosocial variables age and gender. The battery was anonymous, but they were let free to insert their names, if choose to do so. One subject was excluded from the analyses for his age above the upper limit of 50.

RESULTS

Significance of differences between genders and age groups was not computed, given the high data loss in these variables. SENICAL total scores have been computed as the sum of all 27 items in the descriptive analysis. The total SENICAL score without the score of item number 25 was used in those analyses that also involved item n. 25.

The frequency of feelings of "unbearable hunger" (SENICAL item n. 25) has been dealt as a discrete variable, comprising four levels of higher frequency (from 1 to 4). An ANCOVA was computed using age and gender as covariates to examine the degree of overall eating disruption associated to each one of the four levels of perceived "unbearable hunger" (Table 2).

The same variable was used in a frequency analysis with Chi-square, for each SENICAL item against the item 25; in order to reduce the number of frequency cells, and given the wider semantic gap between "*sometimes*" and "*often*" rather than between these two responses and each of the two extreme steps, all items (included item n. 25) were dichotomised into a lower level (response 1 and 2) and a higher level (responses 3 and 4). The value 0 was given to the presence of a lower level ("*never*" and "*sometimes*"), the value 1 to the presence of higher level ("*often*" and "*almost always*") of the frequency each SENICAL item.

The SENICAL (BEB) total scores of the whole sample, subtracted the item 25, are shown in Table 2. These scores, expressing sub-normal eating irregularities, resulted significantly and linearly higher the more often subjects reported "unbearable hunger"; this is also shown with an ANCOVA on the four levels of response of item 25, in which age and gender were used as covariates (Table 2). Hence the degree of disruption of eating habits shows a steadily increasing gradient, independently from age and gender, the more often subjects felt a sense of "unbearable hunger, from "never" to "almost always".

Table 2. Borderline eating behaviors in relation to the frequency of feeling "unbearable hunger"

	Feeling "unbearable hunger"				ANOVA F _{3, 304}	ANCOVA ¹ F _{3, 256}
	1. Never (N = 61)	2. Sometimes (N = 142)	3. Often (N = 44)	4. Always (N = 10)		
SENICAL total ²	48.21 _{2,3,4}	52.49 ₄	56.38 ₁	64.82 ₁	19.83**	19.19**

**p < .01

¹ Covariates: age, gender

² Total SENICAL scores have been calculated by subtracting the item 25 score

Index numbers indicate the groups that differ significantly at the probability (t-tests with Bonferroni corrections)

A post-hoc analysis was performed using t-test with Bonferroni correction. Participants who never feel unbearable hunger differ significantly from all other participants.

Independently from the total SENICAL scores, as shown in the item analysis of Table 3, the reported frequency of eating-related habits co-occurred with the frequency of perceived "unbearable hunger", as measured with Chi-square. Fisher coefficients, providing the direction of correlation, show that they are all in the same direction as predicted: they result negative only for those items whose scores have been reverted to measure BEB (items 2, 4, 6, 12, 21, 22, 27).

Thus, the students scoring higher on the frequency of perceived "unbearable hunger" significantly more often reported a number of disregulated eating-related habits, or BEB. These specific BEB were: to snack between meals, to diet or try to fast, eat at irregular times and not to wait for meal times, to eat more than usual when "under pressure" or when bored, disappointed, sad or angry, to daydream about own favourite foods, to worry about the sense of 'fullness', not to resist to the sight or to the smell of 'inviting' food, to stay in situations that stimulate appetite, to eat quickly and not to taste the food, to feel the urge to vomit after having eaten in excess, to feel 'sick' thinking about own weight increase, and to have foods readily available at hand and within sight, in case of 'hunger'.

Table 3. The frequency of each eating-related habit against the frequency of perceived 'unbearable hunger'

SENICAL Items	Almost never & sometimes	Often & almost always	χ^2	Fisher's r
I snack more than once between meals.	236	75	11.82**	.18**
I always eat at the same times of the day. ^a	194	117	0.15	-.02
Periodically I undergo diets or try to fast.	254	57	14.7**	.20**
I stop eating as soon as I'm full or as soon as I have finished my portions. ^a	147	164	2.51	-.08
Whilst eating, I am involved in some other activity.	258	53	1.56	.07
Even though I have appetite, I wait for lunch or dinner time. ^a	133	178	5.62*	-.13*
Generally, I keep more food than necessary at home.	127	184	1.61	.07
When I'm under pressure, I eat more.	166	145	12.48**	.19**
I eat more whenever I feel bored or angry.	165	146	6.98**	.14**
When I eat out, I eat more than usual.	253	58	1.61	.07
I daydream on my favourite foods.	272	39	18.61**	.23**
I regularly eat at the same time. ^a	183	128	4.17*	-.11*
I use purgatives, laxatives, diuretics and other kinds of medicines.	300	11	1.65	.07
I use medicines that reduce my appetite.	305	6	1.85	.08
If I feel sad, disappointed, angry, I eat more than usual.	234	77	16.91**	.22**
I do not resist the sight or smell of 'inviting' food.	209	102	7.02**	.14**
I chew every bite for a long time. ^a	204	107	2.14	-.08
I really worry if I feel too full or satiated.	233	78	8.08**	.15**
I find myself in situations that stimulate my drive to eat.	256	55	6.41*	.14*
I abuse on coffee or other stimulating substances.	246	65	0.00	.00
I eat slowly and taste the food. ^a	120	191	5.98*	-.13*
I only eat when I truly have appetite. ^a	117	194	0.50	-.04

Table 3. Continued

SENICAL Items	Almost never & sometimes	Often & almost always	χ^2	Fisher's r
When I feel that I've eaten too much I have to take action, maybe by vomiting.	306	5	7.20**	.14*
As soon as my stomach is full, I feel sick thinking how much I will put on weight.	262	49	19.37**	.23**
At times, I feel an unbearable hunger.	249	62	-	-
I have biscuits, fruits and other foods readily available and within sight, in case of hunger.	216	95	6.67**	.14**
I stop eating as soon as I feel satiated. ^a	197	114	0.01	-.00

*p < .05; **p < .01

^a indicates all items whose score has been reverted (5-original score), as the wording defines the opposite habit

- Not computed

DISCUSSION

These results have of course all the limitations of self-reports, which cannot be considered as reliable as direct observations of eating behaviours. However, we have already shown elsewhere (Sibilia, Abruzzo, & Capezzuto, 2008; Sibilia, Tridici, & Carro, 2004) that BEB scores, expressing an overall behavioural dysregulation, are directly and significantly associated with BMI both in obese patients and in normal subjects. Albeit such abnormal eating habits are not serious enough to fulfil the psychiatric criteria for the diagnosis of an eating disorder, nonetheless many of such BEB already are typical targets of CBT of obesity.

Another limitation of the present study is also to note: as mainly females composed the sample, it is questionable if its results can be generalized to males. With this study, however, we have provided new evidence that, in a normal young population, a sense of hunger perceived or believed as "unbearable" is experienced more often by subjects who are more likely to report also a range of irregular eating-related habits and emotional responses, among those we have already called "borderline eating behaviours" (BEB), which favour overeating or are associated to weight gain (Sibilia, Abruzzo, & Capezzuto, 2008; Sibilia, Tridici, & Carro, 2004)⁴. Moreover, the reported frequency of such moments of "unbearable hunger"

⁴ This, which may seem rather an intuitive result, is not so if we consider the biological meaning of the concept of hunger. Besides, in a different analysis (still unpublished) we found that the experience of "unbearable hunger" was not related to body mass index.

measured with the SENICAL scale, resulted linearly related to the frequency of these behaviours: all the associations found between the frequency of the perceived "unbearable" hunger and the other SENICAL items are all in the predicted direction.

These results are not necessarily evidence that the perceived "hunger" has a role in causing each of such untoward eating habits. First, hypotheses about causation are not testable with a cross-sectional study like the present one; rather, longitudinal studies should be considered in order to ascertain the role of hunger as independent measure. Secondly, some of these habits may well have a role of independent variables of perceived "hunger", instead, rather than dependent ones. These could well be habits such as *"to undergo diets or try to fast"*, as any food restriction may increase appetite in normal subjects. Moreover, Laessle, Platte, Schweiger, & Pirke (1996) have shown that, if prolonged enough, food restrictions may produce metabolic, hormonal and psychological responses mimicking bulimia nervosa. In addition, as already Oliver & Wardle (1999) have documented under emotional distress, about 40% of normal young people reports an increase in the amount of food eaten. Thus, emotional distress might well have a role either in increasing the perception of hunger, or the mislabelling of different bodily sensations as "hunger", as modelled in the Figure 1.

Conclusions

It is to note that it is not possible to ascertain with this study whether the feeling labelled "unbearable hunger" stems from the belief that hunger can be unbearable, or from a mindless mislabelling as "hunger" of a normal sense of appetite or of other bodily or emotional responses. Evidence has been provided here only that hunger perceived or believed as "unbearable" is associated to irregularities of eating habits. Therefore, the sense of hunger, combined with the possible role of BEB in weight gain, may well have some implications about the treatment of overweight and obesity. Mislabelling as hunger a variety of conditions, from appetite to emotional tensions, may in fact induce subjects to drop any attempt at sticking to precise meal times or caloric intakes. In particular if hunger is considered as "unbearable", it expresses an irrational belief which may have a role in maintaining the overweight: on one hand it may reduce the motivation to exert any self-control on either eating or on other relevant habits, and to pursue any treatment which requires subjects' active participation; on the other hand, it may confirm subjects' attribution of their condition to biological factors, a common clinical observation for those who work with the obese.

Finally, as Shaw et al. (2005) have documented in a thorough meta-analysis, there is firm evidence that CBT is effective in producing a clinically significant and persistent weight loss in obese patients. However, its effectiveness is far from providing satisfactory results for every patient. In fact, cases are rare in which the

weight loss is of such a magnitude or so persistent to bring to a steady recovery of normal weight. Obviously, the variance of outcomes of CBT in obesity can be attributed to a range of different factors, but here we may have provided some evidence that one of them, namely the belief of experiencing an "unbearable hunger", could be cognition well worth to be targeted for change.

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