



Evaluation of diagnostic criteria for night eating syndrome using item response theory analysis

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ABSTRACT

Uniform diagnostic criteria for the night eating syndrome (NES), a disorder characterized by a delay in the circadian pattern of eating, have not been established. Proposed criteria for NES were evaluated using item response theory (IRT) analysis. Six studies yielded 1,481 Night Eating Questionnaires which were coded to reflect the presence/absence of five night eating symptoms. Symptoms were evaluated based on the clinical usefulness of their diagnostic information and on the assumptions of IRT analysis (unidimensionality, monotonicity, local item independence, correct model specification), using a two parameter logistic (2PL) IRT model. Reports of (1) nocturnal eating and/or evening hyperphagia, (2) initial insomnia, and (3) night awakenings showed high precision in discriminating those with night eating problems, while morning anorexia and delayed morning meal provided little additional information. IRT is a useful tool for evaluating the diagnostic criteria of psychiatric disorders and can be used to evaluate potential diagnostic criteria of NES empirically. Behavioral factors were identified as useful discriminators of NES. Future work should also examine psychological factors in conjunction with those identified here.

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1. Introduction

Original criteria for the night eating syndrome (NES) were based on a patient in whom the disorder was first noted and the subsequent treatment of 25 obese persons referred to a Special Study Clinic because of difficulties managing their obesity (Stunkard, Grace, & Wolff, 1955). These criteria were: (1) consumption of at least 25% of daily caloric intake after the evening meal, (2) initial insomnia at least half of the time, and (3) morning anorexia. Revision of the criteria in 1999 added: (1) nighttime awakenings (at least one per night), (2) frequently accompanied by the ingestion of snacks; (3) an increase in the requirement for evening hyperphagia to greater than 50% of daily caloric intake; (4) a duration of three months; and (5) absence of bulimia nervosa and binge eating disorder (BED) (Birketvedt et al., 1999). The last criterion has not been included in other studies, while initial insomnia was not considered in this report.

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Studies of NES have employed variations of these criteria (see de Zwaan, Burgard, Schenck, & Mitchell, 2003 for review), including the use of different cut-times for evening hyperphagia: 7 pm (Cerú-Björk, Andersson, & Rössner, 2001; Striegel-Moore, Franko, Thompson, Affenito, & Kraemer, 2006; Stunkard et al., 1996), after the evening meal (Birketvedt et al., 1999, Marshall, Allison, O'Reardon, Birketvedt, & Stunkard, 2004; O'Reardon et al., 2004), after 11 pm (Striegel-Moore et al., 2006), and simply, evening eating (Kuldau & Rand, 1986; Rand et al., 1997). The proportion of calories used to define evening hyperphagia has also varied by study, from 25% (Stunkard et al., 1955; Allison, Grilo, Masheb, & Stunkard, 2005; Allison et al., 2006) to 50% (Birketvedt et al., 1999; Stunkard et al., 1996), to simply overeating or excessive eating during the evening (Kuldau & Rand, 1986; Rand, MacGreggor, & Stunkard, 1997). Some NES studies have examined putative NES samples which have had nocturnal ingestions or evening hyperphagia (Cerú-Björk et al., 2001; Grilo & Masheb, 2004; Napolitano, Head, Babyak, & Blumenthal, 2001) as well as samples that included persons who had either of these or both criteria (Allison et al., 2007; Allison et al., 2006; Allison et al., 2005; O'Reardon et al., 2004; Pawlow, O'Neil, & Malcolm, 2003). Striegel-Moore and colleagues (2004, 2006) tested several of these definitions with a sample of adolescent girls and a representative national sample ages 13 and older, demonstrating decreases in the proportion of those reporting nocturnal eating with increasingly stringent criteria.

Two prevalence studies of NES in the general population for adults revealed rates of 1.5% (Rand et al., 1997) and 5.2% (Lamerz et al., 2005). Prevalence estimates in obesity clinics are higher, ranging from 6% (Cerú-Björk et al., 2001) to 14% (Gluck, Geliebter, & Satov, 2001), and in pre-operative bariatric surgery patients from 8% (Adami, Meneghelli, & Scopinaro, 1999; Allison et al., 2006) to 42% (Hsu, Bentancourt, & Sullivan, 1996). Among psychiatric outpatients 12% have NES, with obese patients 5.2 times more than normal weight patients to be diagnosed (Lundgren et al., 2006). Differences in diagnostic criteria across studies, including the timeframe used for evening hyperphagia and assessment of nocturnal ingestions, may contribute to the inconsistencies in this relationship.

Depressed mood has also been linked to NES in several studies (Birketvedt et al., 1999; O'Reardon et al., 2004; Gluck et al., 2001; de Zwaan, Roerig, Crosby, Karaz, & Mitchell, 2006), with mood falling as the day progresses for many (Birketvedt et al., 1999). Lifetime occurrence of major depressive disorder based on DSM-IV diagnostic criteria is high at 56% (de Zwaan et al., 2006).

Finally, NES has a low to moderate overlap with BED, ranging from 0% to 26.5% (see de Zwaan et al. 2003 for review). Comparisons between individuals with these disorders suggest that they are different constructs (Allison et al., 2005). Probably most specifically, those with NES have more disturbed sleep, and their nocturnal ingestions are not objectively large (Birketvedt et al., 1999). More work is needed regarding the relationship between the timing of binges of those with BED and the concept of evening hyperphagia. However, evidence suggests that NES and BED are distinct; thus, NES needs its own, valid diagnostic criteria.

To assess the core features and psychopathology associated with NES, we used the Night Eating Questionnaire (Allison et al., 2008) which contains items descriptive of NES (see Table 1) and has an alpha for the total score of .70. Vander Wal, Waller, Klurfeld, McBurney, and Dhurandhar (2005) verified that the NEQ was positively correlated with increasingly complex definitions of NES. We sought to understand how each of the features described clinically and contained in the NEQ is related to the overall construct of night eating syndrome by implementing item response theory techniques.

1.1. Item response theory (IRT)

IRT is a theoretical framework for psychological measurement. It provides an attractive alternative to Classical Test Theory (CTT) because of its potential for solving many practical testing problems (Lord, 1980; Weiss & Yoes, 1991). CTT and IRT share the assumption that measurement involves the location of individuals along some latent (i.e., not directly measurable) dimension, typically referred to as the *trait level*. The primary distinction between the methods is that IRT, unlike CTT, is a model-based theory of measurement. IRT assumes that a person's trait level can be estimated from responses to individual items. An IRT model specifies precisely how a person's response to an item is related both to the trait level for that individual as well as several properties of that item (described below). Additionally, IRT estimates an individual's location on the latent trait by using both the pattern of item responses and the estimated item parameters. In contrast, trait level estimates are obtained by summing response across items in CTT.

The IRT model involves four assumptions. (1) The latent construct of interest must be *unidimensional*. All items evaluated are assumed to measure a single common latent trait. (2) *Monotonicity* specifies that as the probability of endorsing one item increases, so does the probability of endorsing other items. (3) The IRT model must fit the observed data by using the correct number of parameters, i.e., *correct model specification*. (4) *Local item independence* dictates that the probability of response to any item is independent of the response to any other item after taking into account person (θ) and item parameters (difficulty,

Table 1

Cut-off descriptors for Night Eating Questionnaire items retained in the IRT analysis and their parameter estimates (standard errors) for the two parameter logistic fully unconstrained IRT model

Symptom	Symptom is "present"	Discrimination	Difficulty
Morning anorexia	≤ "Somewhat hungry"	.55 (.04)	.66 (.07)
Delayed morning meal	12:01 PM or later	.73 (.05)	1.44 (.09)
Evening hyperphagia or Nocturnal eating	≥26% of calories after supper and/or nocturnal eating "about half the time"	1.25 (.07)	.53 (.04)
Initial insomnia	"About half the time"	.99 (.06)	.82 (.05)
Night awakenings	"More than once a week"	.90 (.05)	.71 (.05)

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