



# Development and validation of the Dimensional Anhedonia Rating Scale (DARS) in a community sample and individuals with major depression



Sakina J. Rizvi<sup>a,b,\*</sup>, Lena C. Quilty<sup>c,d</sup>, Beth A. Sproule<sup>e,f</sup>, Anna Cyriac<sup>a</sup>, R. Michael Bagby<sup>d,g</sup>, Sidney H. Kennedy<sup>a,d,h</sup>

<sup>a</sup> Department of Psychiatry, University Health Network, Toronto, Ontario, Canada

<sup>b</sup> Departments of Pharmaceutical Sciences and Neuroscience, University of Toronto, Toronto, Ontario, Canada

<sup>c</sup> Campbell Family Mental Health Research Institute, Centre for Addiction and Mental Health, Toronto, Ontario, Canada

<sup>d</sup> Department of Psychiatry, University of Toronto, Ontario, Canada

<sup>e</sup> Department of Clinical Pharmacy, Centre for Addiction and Mental Health, Toronto, Ontario, Canada

<sup>f</sup> Department of Pharmaceutical Sciences, University of Toronto, Toronto, Ontario, Canada

<sup>g</sup> Department of Psychology, University of Toronto, Ontario, Canada

<sup>h</sup> Department of Psychiatry, St. Michael's Hospital, Toronto, Ontario, Canada

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## ABSTRACT

Anhedonia, a core symptom of Major Depressive Disorder (MDD), is predictive of antidepressant non-response. In contrast to the definition of anhedonia as a “loss of pleasure”, neuropsychological studies provide evidence for multiple facets of hedonic function. The aim of the current study was to develop and validate the Dimensional Anhedonia Rating Scale (DARS), a dynamic scale that measures desire, motivation, effort and consummatory pleasure across hedonic domains. Following item selection procedures and reliability testing using data from community participants ( $N=229$ ) (Study 1), the 17-item scale was validated in an online study with community participants ( $N=150$ ) (Study 2). The DARS was also validated in unipolar or bipolar depressed patients ( $n=52$ ) and controls ( $n=50$ ) (Study 3). Principal components analysis of the 17-item DARS revealed a 4-component structure mapping onto the domains of anhedonia: hobbies, food/drink, social activities, and sensory experience. Reliability of the DARS subscales was high across studies (Cronbach's  $\alpha=0.75-0.92$ ). The DARS also demonstrated good convergent and divergent validity. Hierarchical regression analysis revealed the DARS showed additional utility over the Snaith–Hamilton Pleasure Scale (SHAPS) in predicting reward function and distinguishing MDD subgroups. These studies provide support for the reliability and validity of the DARS.

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## 1. Introduction

In recent years, the assessment of anhedonia has seen a resurgence of interest. This has been borne out of findings from several large scale studies, including the Sequenced Treatment Alternatives to Relieve Depression (STAR\*D) and the Genome Based Therapeutic Drugs for Depression (GENDEP), which have demonstrated that loss of interest (anhedonia) is a predictor of non-response to selective serotonin reuptake inhibitors (SSRIs) (Uher et al., 2008; 2012). This was also observed in an adolescent MDD sample, wherein among symptom dimensions, anhedonia

was found to be the only unique negative predictor of time to remission and depression free days with SSRI use (McMakin et al., 2012). Providing further generalizability across treatment modalities, anhedonia was a predictor of non-response to repetitive transcranial magnetic stimulation (rTMS) of the dorsomedial prefrontal cortex in MDD (Downar et al., 2014).

Notably, there is a paucity of measures and tasks validated for use in MDD that tap into the different facets of a “pleasure response”. Traditionally, anhedonia has been defined as a “loss of pleasure” (Ribot, 1986), a definition that emphasizes the consummatory/enjoyment aspect of reward function. However, anhedonia within the DSM-5 reflects a broader conceptualization that includes interest as well as consummatory pleasure. Even within the widely-used Hamilton Depression Rating Scale, a single anhedonia item is used to measure a dimensional construct

\* Corresponding author at: Department of Psychiatry, University Health Network, 200 Elizabeth St, 8EN-238B, Toronto, ON, Canada M5G 2C4, Fax: +1 416 340 5317. E-mail address: [sakina.rizvi@uhn.ca](mailto:sakina.rizvi@uhn.ca) (S.J. Rizvi).

including desire, effort and consummatory pleasure (Hamilton, 1960). This equivocal conceptualization makes anhedonia measurement difficult and imprecise. As Treadway and Zald (2011) assert “heterogeneity at the level of symptom definition is at least as problematic as...issues of comorbidity...” thus, refining this construct is imperative if we hope to understand the neurobiological underpinnings of anhedonia. Consequently, it may be more helpful to explicitly use anhedonia as an umbrella term for impairment of hedonic function over a spectrum of behaviors reflecting initial interest/desire (wanting a reward), anticipation (expectation of a reward), motivation (initial energy expenditure to attain a reward), effort (sustained energy expenditure to attain reward), and consummatory pleasure (enjoyment of reward).

The four main validated self-report measures used in clinical research to assess anhedonia are the Snaith–Hamilton Pleasure Scale (SHAPS) (Snaith et al., 1995), the Fawcett–Clark Pleasure Capacity Scale (FCPS) (Fawcett et al., 1983), the Revised Chapman Physical Anhedonia Scale (CPAS) and the Chapman Social Anhedonia Scale (CSAS) (Chapman et al., 1976). Ideally, a scale quantifying anhedonia in the context of MDD should be able to detect state versus trait differences, measure different aspects of anhedonia, distinguish between anhedonia and related constructs, and be appropriate for use in samples with a range of cultural beliefs and preferences (generalizability). These four measures differ in their ability to address these factors.

First, the CPAS/CSAS measure trait anhedonia (queries general response), whereas the FCPS and SHAPS measure state anhedonia (queries “right now” and “last few days”, respectively). It is still unclear whether anhedonia or its subcomponents are stable constructs over time in depressed patients (trait) or whether it is a symptom that fluctuates depending on severity or even antidepressant mechanism (state). While anhedonia is a symptom of a depressive episode, there is evidence to suggest that this symptom persists even in the remitted state (Nierenberg et al., 1999; Pedrelli et al., 2010). As such, it would be prudent to test the stability of anhedonia. Therefore, a scale that is able to assess responses “right now” versus “over time” or “in general” would be ideal for measurement in MDD, since they allow for frequent repeat testing. As a result, both the FCPS and SHAPS may be more beneficial in capturing information in the context of a depressive episode. For example, in a sample of inpatients, anhedonia scores based on the FCPS were stable over 7 months despite recovery in two thirds of patients (Clark et al., 1984); however, as inpatients this group may reflect a more chronically ill group. In another naturalistic study in chronic MDD patients, anhedonia (based on the FCPS) did not change over a 1 year follow-up despite reductions in depressive symptoms (Schrader, 1997). Second, the CPAS and CSAS measure pleasure in addition to personality traits, whereas both the FCPS and SHAPS focus exclusively on consummatory pleasure. All four scales incorporate questions relating to both primary and secondary reward; for example, food and sex represent “primary” rewards (inherent rewards), whereas photography or money are secondary rewards (no inherent reward in itself and for which reward value must be learned). Third, both the SHAPS and FCPS exhibit good convergent and discriminant validity: they moderately correlate with depression severity as would be expected, but do not correlate with measures of anxiety (Leventhal et al., 2006; Nakonezny et al., 2010). In contrast, the CPAS has a weak correlation with depression severity, and both the CPAS and CSAS have strong associations with non-affective aspects of personality and psychotic disorders (Leventhal et al., 2006). Fourth, the CPAS, CSAS as well as the FCPS exhibit a high degree of cultural bias, as demonstrated in questions such as “I always find organ music dull and unexciting” (CPAS) or “you are skiing down a mountain very fast while still in good control of yourself” (FCPS). The SHAPS was constructed to avoid cultural bias and so contains items with

wider applicability (“I would be able to enjoy my favourite meal”). As a result, however, one could argue that it does not capture the events or activities that are likely to elicit strong hedonic responses (Lang et al., 2012). The ability to accurately tap into the subjective nature of what individuals find pleasurable or interesting is the greatest challenge in measuring anhedonia.

The development of the Dimensional Anhedonia Rating Scale (DARS) was primarily driven by a need to ensure the assessment of anhedonia with an instrument tapping interest, motivation, effort and pleasure. All four dimensions may be necessary to elicit a complete hedonic response, and a deficiency in any of these dimensions could consequently reduce the experience of pleasure. Neuroscientific evidence suggests that multiple, distinct aspects of reward processing can give rise to loss of pleasure. For example, depressed patients reported similar levels of consummatory pleasure but lower levels of reward anticipation compared to healthy controls (Sherdell et al., 2012). Furthermore, levels of reward anticipation were associated with motivation for effort expenditure only in the participants with MDD (Sherdell et al., 2012). There is evidence that MDD patients have reduced ability to detect reward compared to healthy controls and exhibit reduced brain activity when a reward has occurred, which suggests individuals with MDD do not experience the same level of feedback from rewards as healthy controls (Gradin et al., 2011; Kumar et al., 2008). Taken together, it appears that reward-related deficits in MDD impact much more than consummatory pleasure, and available tasks and tools need to fully reflect all components of reward processing in order to yield an adequate assessment of this cardinal symptom of depression. Inclusion of these elements (desire, motivation, effort and consummatory pleasure) in the DARS is expected to capture a comprehensive representation of the individual anhedonic experience consistent with current neurobiological models.

The development and validation of the DARS was performed in three studies: (1) item selection and preliminary internal reliability testing within a sample of community participants (Study 1), (2) cross-validation of reliability estimates from Study 1 and convergent and discriminant validity assessment in an online study using community participants (Study 2), and (3) reliability and validity testing of the DARS using unipolar or bipolar depressed patients and healthy controls (Study 3).

## 2. Study 1: Item selection

### 2.1. Methods

#### 2.1.1. Item generation

The DARS is a self-report scale that measures anhedonia across the following 4 domains: hobbies/past-times, food/drinks, social activities, and sensory experiences. Within each domain, participants are required to provide at least two of their own examples of what they find rewarding (e.g. “gardening, playing the guitar” under “hobbies/past-times”). Illustrative examples are provided within each domain (see Appendix). Subsequently, participants answer a set of standardized questions about desire, motivation, effort and consummatory pleasure for the examples provided.

An item pool comprised of 34 items was created across the domains. The domains were based on results from the factor analysis of focus group data obtained during the SHAPS development (Snaith et al., 1991). Novel items were generated (by SR) within each domain to ensure the presence of at least one item assessing desire, motivation, effort and pleasure. The DARS was designed to be useful in clinical and research settings (i.e. easy to use, minimal participant burden). Consequently, we developed it as a self-report questionnaire with the aim of reducing the item

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