

# How to Interpret Nutrition Drink Test

Moo In Park

Department of Internal Medicine, Kosin University College of Medicine, Busan, Korea

Nutrient drink test is one of the drink test techniques to assess gastric accommodation and to quantify meal-induced symptoms. It uses nutrient-containing solution instead of water and has been proposed as a surrogate method for estimating gastric volumes and validated for assessing satiation, sensation of bothersome symptoms after meal ingestion. Various nutrient-containing solution and drinking rates have been used and there were no widely accepted reference values for nutrient drink test until now. However, tests results are usually reported as the maximum tolerated volume, individual and cumulative symptom scores. The accommodation response, gastric sensation and gastric emptying may influence the maximum tolerated volume of nutrient drink. Although drink test is a useful tool for assessing gastric accommodation and sensation, it remains unclear exactly what physiologic processes are assessed by nutrient drink tests.

(J Neurogastroenterol Motil 2011;17:88-90)

## Key Words

Drink; Maximum tolerated; Nutrient

## Introduction

Assessment of gastric sensation and accommodation is measured using a barostat-balloon study. This is the gold standard for their measurement, however it is invasive, time consuming and uncomfortable, therefore is not considered suitable for routine clinical practice.<sup>1</sup> To overcome these shortcomings, drink tests were developed as a noninvasive methods to assess gastric sensation and accommodation. Drink tests are well tolerated, inexpensive and easy to perform.

It is still unclear whether drink tests estimate gastric sensation and accommodation exactly.<sup>1-3</sup> Although drink tests have not been used in clinical practice, they are often performed in clinical researches evaluating patients with functional dyspepsia or gastroparesis.<sup>4</sup> Nutrient drink tests seem to be performed more often

than water load tests in clinical research despite no comparative studies among them. This paper deals with performance and interpretation of nutrient drink tests.

## Performing Nutrient Drink Tests

Nutrient drink tests should be performed in the morning after an overnight fast. Any medications which can alter gastrointestinal sensation, accommodation or gastric emptying can be stopped before performing nutrient drink tests. Different nutrient drink tests based on various nutrient containing solutions, are performed with various drinking rates.<sup>1-3</sup> Nutrient drink test developed by Mayo Clinic presents the simplest method among other tests.<sup>4</sup> Subjects consume 120 mL of Ensure™ (Abbott Laboratories, Abbott Park, IL, USA), which contains 1.06 kcal/mL with 65% of carbohydrate, 20% of fat and 15% of protein, every 4

Received: December 13, 2010 Revised: January 8, 2011 Accepted: January 10, 2011

© This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

\*Correspondence: Moo In Park, MD

Department of Internal Medicine, Kosin University College of Medicine, 34 Amnam-dong, Seo-gu, Busan 602-702, Korea  
Tel: +82-51-990-6719, Fax: +82-51-990-5055, E-mail: mipark@ns.kosinmed.or.kr

Financial support: None.

Conflicts of interest: None.

**Table.** Nutrient Drink Test Results: Adolescents vs Adults (Adapted from Chial et al<sup>5</sup>)

Assessment	Males			Females		
	Adolescents	Adults	<i>P</i> -value	Adolescents	Adults	<i>P</i> -value
Maximum tolerated volume (mL)	1,101 ± 109	1,516 ± 115	0.006 <sup>a</sup>	80 ± 64	1,269 ± 57	< 0.0001 <sup>a</sup>
Aggregate symptom score	138 ± 13	158 ± 15	0.3 <sup>b</sup>	160 ± 13	200 ± 18	0.2 <sup>b</sup>
Nausea	24 ± 6	31 ± 6	0.4 <sup>b</sup>	41 ± 6	44 ± 6	0.9 <sup>b</sup>
Bloating	38 ± 6	49 ± 6	0.2 <sup>b</sup>	10 ± 7	64 ± 5	0.0006 <sup>b</sup>
Pain	14 ± 5	31 ± 8	0.1 <sup>b</sup>	18 ± 4	48 ± 7	0.007 <sup>b</sup>
Fullness	62 ± 5	47 ± 8	0.2 <sup>b</sup>	72 ± 4	44 ± 8	0.07 <sup>b</sup>

<sup>a</sup>Mann-Whitney test using body mass index as a covariate, <sup>b</sup>Mann-Whitney test using maximum tolerated volume as a covariate.

minutes until full.<sup>5</sup> Ensure is administered in a paper cup that is refilled every 4 minutes. At 5 minute intervals, subjects score fullness using a rating scale that combines verbal descriptors on a scale graded 0-5 (0: no symptoms, 1: first sensation of fullness [threshold], 2: mild, 3: moderate, 4: severe and 5: maximum or unbearable fullness). Subjects are told to stop when a score of 5 is obtained. The actual volume of Ensure consumed at this point is the maximum tolerated volume. Postprandial symptoms were measured 30 minutes after completing the test with participants scoring each symptoms of bloating, fullness, nausea and pain on a visual analogue scale with 100 mm lines and the words “unnoticeable” and “unbearable” as anchors. The sum of the four 100 mm visual analogue scales for each symptom provides an aggregate symptom score.

### Normal Values for Nutrient Drink Tests —

Boeckxstaens et al<sup>1</sup> have reported normal values for Nutridrink<sup>TM</sup> (N.V. Nutricia, Zoetermeer, Netherlands), which contains 1.5 kcal/mL with 39% of fat, administered at 100 mL/min. Males significantly consumed more Nutridrink (1,405 ± 81 mL vs 946 ± 74 mL, *P* = 0.002) than females in this rapid caloric drinking test. Using the 10th percentile as the lower limit of the normal range, Nutridrink volumes of < 800 mL for men and < 600 mL for women were considered abnormal.

In a Nutridrink drink test administered at a rate of 15 mL/min to healthy volunteers, Tack et al<sup>2</sup> reported that maximum satiation occurred after ingestion of 1,005 ± 35 mL (mean ± SE) with a lower limit of normal as 653 mL. In the Ensure drink test done by Chial et al,<sup>5</sup> where 30 healthy adolescents and 40 adults ingested Ensure at a rate of 30 mL/min, an average maximum tolerated volume (mean ± SE) was 1,181 ± 50 mL (Table). There was a weak but significant correlation (*r* = 0.29, *P* = 0.02) between the volume to fullness and body mass index.

### Interpreting Test Results —

Nutrient drink test results are reported as the maximum tolerated volume, 4 individual and aggregate symptom scores. If emesis occurs, the volume of emesis should be recorded and subtracted from the total ingested volume. An extremely low maximum tolerated volume may suggest that extra-gastric or central factors are playing an important role in symptom generation, while low maximum tolerated volume may predict impaired gastric accommodation.

Some patients with functional dyspepsia showed lower maximum tolerated volumes than controls. Since several physiologic factors including gastric sensation, accommodation and gastric emptying may influence the maximum tolerated volume of nutrient drink, the results of maximum tolerated volume cannot be used to guide therapy.

Four individual and aggregate symptom scores are more likely to be higher in patients with functional dyspepsia than controls.

### Conclusion —

Various nutrient drink tests are used in clinical researches evaluating patients with unexplained upper gastrointestinal symptoms. Standardization of nutrient drink tests is required to be widely performed in patients with functional dyspepsia. The maximum tolerated volume, individual and cumulative symptom scores can be reported as results of nutrient drink tests.

### References —

1. Boeckxstaens GE, Hirsch DP, van den Elzen BD, Heisterkamp SH, Tytgat GN. Impaired drinking capacity in patients with func-

- tional dyspepsia: relationship with proximal stomach function. *Gastroenterology* 2001;121:1054-1063.
2. Tack J, Caenepeel P, Piessevaux H, Cuomo R, Janssens J. Assessment of meal induced gastric accommodation by a satiety drinking test in health and in severe functional dyspepsia. *Gut* 2003;52:1271-1277.
  3. Gonenne J, Castillo EJ, Camilleri M, et al. Does the nutrient drink test accurately predict postprandial gastric volume in health and community dyspepsia? *Neurogastroenterol Motil* 2005;17:44-50.
  4. Jones MP. Satiety testing: ready for clinic? *World J Gastroenterol* 2008;14:5371-5376.
  5. Chial HJ, Camilleri C, Delgado-Aros S, et al. A nutrient drink test to assess maximum tolerated volume and postprandial symptoms: effects of gender, body mass index and age in health. *Neurogastroenterol Motil* 2002;14:249-253.