Mapping Bracco's Varibar® barium products to the IDDSI Framework

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In the past few months, formal decisions to move towards implementation of the International Dysphagia Diet Standardisation Initiative (IDDSI) Framework have been announced by the American Academy of Nutrition and Dietetics, the American Speech-Language Hearing Association, Dietitians of Canada, Speech-Language Audiology Canada, Dietitians of Australia and Speech Pathology Australia, among others. A highlight of the IDDSI Framework (www.iddsi.org) is the specification of simple testing methods that can be used by clinicians, caregivers and food service professionals to confirm the texture and flow characteristics of foods and liquids for people with dysphagia. A particularly exciting aspect of these tests is the opportunity for clinicians to ensure a match between the flow properties of the liquids they use in swallowing assessment and liquids they recommend for a patient's diet.

In the United States, Varibar® is a line of barium products available from Bracco that is designed specifically for use in videofluoroscopic swallowing studies. These products have a low concentration of barium (40% w/v), which is designed to be visible in fluoroscopy but should not leave a coating behind on the mucosal walls of the pharynx. The Varibar® products come in 4 different liquid consistencies, labelled "thin", "nectar", "thin honey" and "honey", consistent with the terminology used in the National Dysphagia Diet (1992). The target viscosities for these products, in centipoise (cP) are described as 4 cP, 300 cP, 1500 cP, and 3000 cP, respectively, with these measures quoted at a shear rate of 30 reciprocal seconds. For reference, the viscosity ranges used in the National Dysphagia Diet for thin, nectar, honey and spoon-thick liquids were 0-50, 51-350, 351-1750 and > 1750 cP, quoted at a slightly higher shear rate of 50 reciprocal seconds. A 5th Varibar® product ("Pudding") is also available and is intended to have a pureed consistency (with a target viscosity of 5000 cP at 30/s).

IDDSI has been receiving a large number of questions from clinicians who want to understand how the Varibar® products map to the IDDSI Framework. Mapping from viscosity to IDDSI flow levels is a similar challenge to mapping temperature from the Fahrenheit to the Celsius scale, as shown in Table 1 below:

Fahrenheit	-40°F	-30°F	-20°F	-10°F	0°F	10°F	20°F	32°F	40°F	50°F	60°F	70°F	80°F	90°F	100°F	110°F	120°F
Celsius	-40°C	-34°C	-29°C	-23°C	-18°C	-12°C	-7°C	0°C	4°C	10°C	16°C	21°C	27°C	32°C	38°C	43°C	49°C

Table 1. Mapping between the Fahrenheit and Celsius temperature scales.

In order to confirm the mapping of the Varibar® product line to the new IDDSI Framework, we arranged for testing to be done by clinicians in 3 different cities, using different batch numbers of Varibar®. The Varibar® liquids were tested at room temperature using the IDDSI Syringe Flow Test, and several repeated tests were performed at each site. The IDDSI Syringe Flow Test measures the amount of residual liquid (in ml) remaining behind in a 10ml slip tip syringe after 10 seconds of flow. Instructions for performing the test can be found at: http://iddsi.org/framework/drink-testing-methods/. The results of the Varibar® product testing are shown in Table 2 and Figure 1, below.

Varibar Product	IDDSI Syringe Flow Test Result (ml)		IDDSI Result (Level # and Name)
	Mean	Standard Deviation	
Thin 40%	0.0	0.0	Level 0 - Thin
Nectar 40%	4.9	0.4	Level 2 - Mildly-thick
Thin Honey 40%	9.8	0.0	Level 3 - Moderately-thick
Honey 40%	9.9	0.1	? Level 4 - Extremely-thick

Table 2. IDDSI Syringe Flow Test results for Bracco Varibar® barium products.

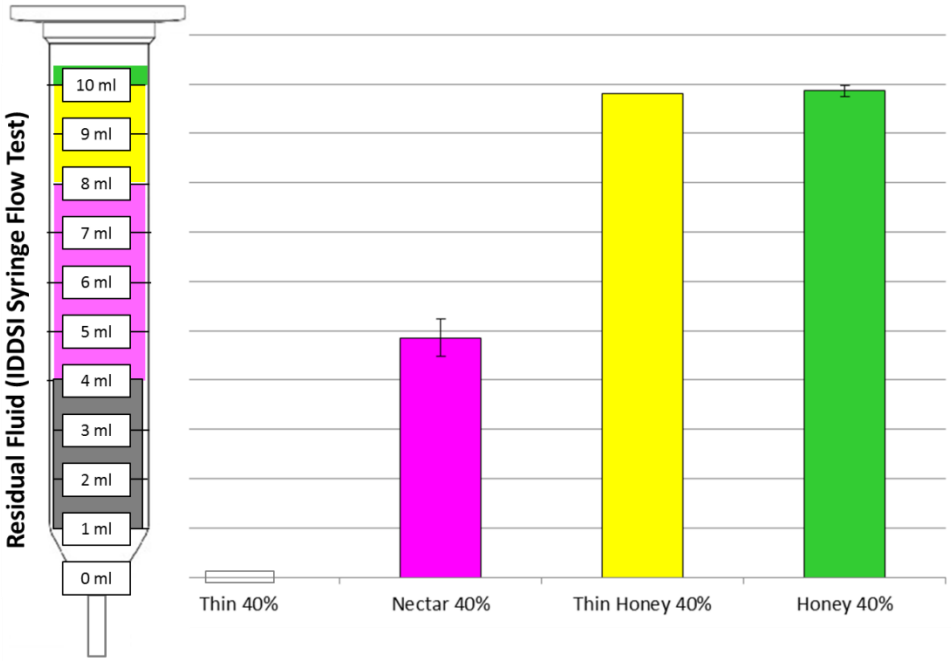

Figure 1. IDDSI Syringe Flow Test Results for Bracco Varibar® barium products.

Varibar® Thin, Nectar and Thin Honey

These results show that Varibar® Thin tests within Level 0 (Thin) of the IDDSI Framework, meaning that the entire 10 ml sample flowed out of the syringe in less than 10 seconds. Varibar® Nectar tested within the mildly-thick range and the Varibar® Thin Honey tested close to the upper boundary of the moderately-thick range.

Varibar® Honey

The Varibar® Honey results in Table 2 are shown with a question mark and probable classification as an IDDSI Level 4 extremely-thick liquid. This product was observed to produce 2-3 drips from the syringe within the 10 second test period. When this sort of result is seen, it means that the liquid is testing right at the boundary between moderately-thick and extremely-thick liquids and is really too thick to be tested using the syringe flow test. The IDDSI Framework testing methods instructions suggest that spoon-tilt or fork drip tests should be done to confirm flow characteristics at this level

(http://iddsi.org/framework/food-testing-methods/). When the fork drip test was performed with the Varibar® Honey, it behaved like an extremely-thick liquid, sitting in a mound on top of the fork with a small drop or tail developing below but not actively flowing or dripping between the prongs of the fork. With the spoon-tilt test, the Varibar® Honey fell off a tilted spoon in a single bolus. For comparison, when the spoon-tilt test was performed with the Varibar® Thin Honey, the product flowed in a continuous stream off the spoon.

Interestingly, the Varibar® Thin Honey, Honey and Pudding products all left quite a lot of residue behind when the spoon-tilt test was performed, suggesting that they are quite sticky. It should be noted that one of the specific goals behind developing the Varibar® product line was to ensure that the barium would flow through the oropharynx without leaving a coating on the mucosa. This goal supports the interpretation that residual barium in the oropharynx reflects impaired swallowing efficiency rather than an artifact of the coating properties of barium sulfate. The observation that these products coat a spoon should not be presumed to mean that the product will also leave a coating in the pharynx. The Varibar® product may appear sticky in a dry environment or in contact with a metal or plastic utensil, while performing differently in a moist mucosal environment such as the oropharynx.

Conclusion

We hope these results are useful as a guide for clinicians who want to understand the mapping between the Varibar® products and the IDDSI Framework. For clinicians outside the United States who cannot access the Varibar® products, similar testing is planned with other barium products and water-soluble low-osmolar iodinated contrast media. Regardless of the product used, we recommend using the IDDSI Syringe Flow test to understand the flow characteristics of your assessment stimuli and the match between assessment stimuli and liquids available for inclusion on a patient's diet.

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