Comparative Study On Practicability Of 9-Point Hedonic Scale And 5-Point Hedonic Scale For Beverages

M. Cheng[1], M. McCulloch[1], R. Tran[1], J. Chang[1], S. Harris[1], T. Nakamura[1], S. Pecore[2]

[1] Herbalife International Inc., Torrance, CA 90502, [2] P&D consulting LLC , Pasadena, CA 91106

Abstract

This study was to investigate whether the 9-point and 5-point hedonic scales were interchangeable while comparing the performance, potential limitations, and effects on the other typical consumer testing (preference, ranking, attribute diagnostics, etc.) for both scales. Herbalife's employee consumer panel (N= ~100) evaluated multiple flavored protein shakes and Cranberry flavored Aloe drink using both 9-point and 5-point hedonic scales, respectively. High correlations (R^2 =0.96) were observed between the two scales in all liking attributes, while the 9-point scale demonstrated a higher sensitivity than the 5-point scale in acceptance discrimination. Ranking results may be associated with the hedonic scores, as the 9-point hedonic scale was more discriminate than the 5-point. Meanwhile, no difference was found for the preference, attribute diagnostics, and usage frequency / intent questions in this study.

Introduction

The most common scale for acceptance testing is the 9-point hedonic scale that was developed in the United States (US) about 70 years ago [1,2]. A few studies have been conducted to compare 9-point hedonic with 11-point category scale, labeled affective magnitude (LAM), unstructured line scale, best-worst scaling, while the advantages and limitations of 9-point hedonic scale were discussed[2,3]. However, 5-point or 7-point hedonic scales were rarely studied or discussed which may be used in some contexts, for example, for minors, or adults with limited education level, etc. The food development trends are focusing on less processed, less sugar, less salt, allergen-free in these years[4] , which may request a more discriminating consumer acceptance method such as 9-point hedonic scale because of the nature of subtle changes.

When comparing these 2 hedonic scales, an important criterion is whether one scale is better at finding differences among products[2,3].   Although the 9-point hedonic scale is believed to be more sensitive than the 5-point hedonic scale in discrimination, it is beneficial to know whether there is any interactions between the hedonic scales and the other consumer testing questions. The objectives of this research were to compare the 9-point and 5-point hedonic scales in beverage acceptance testing and how the panelists respond to the typical consumer questions following the hedonic tests.

Materials and Methods

Central Location Test
Beverage samples were prescreened and selected to cover the full range of hedonic ratings.

Sample: A total of 9 samples were tested, including 2 Chocolate flavored whey protein based shake samples, 2 pairs of Vanilla flavored plant protein based shake samples, and 3 Cranberry flavored Aloe Drink samples with sugar (0g, 2g, and 4g/serving).   Contact Dr. Cheng for further details on samples.

Panelists:
90-110 Herbalife employees (screened as heavy users of protein shake or aloe drinks, respectively) were recruited for the tests with 5-point scale or 9-point hedonic scale individually. All were familiar with the 5-point scale as is typically used at Herbalife. About 50-55 panelists participated in both 5 and 9-point hedonic scale testing for the same sample sets.

Test Method:
CLTs were conducted in Herbalife Sensory testing booths in Torrance, CA. The whey protein shake samples were tested monadically; the two pairs of plant protein shakes and the aloe drink samples were tested simultaneously by their groups, respectively.
The questionnaires included hedonic (see below for an example), JAR (Just About Right), usage frequency / intent, paired preference, or ranking questions.

Data Analysis
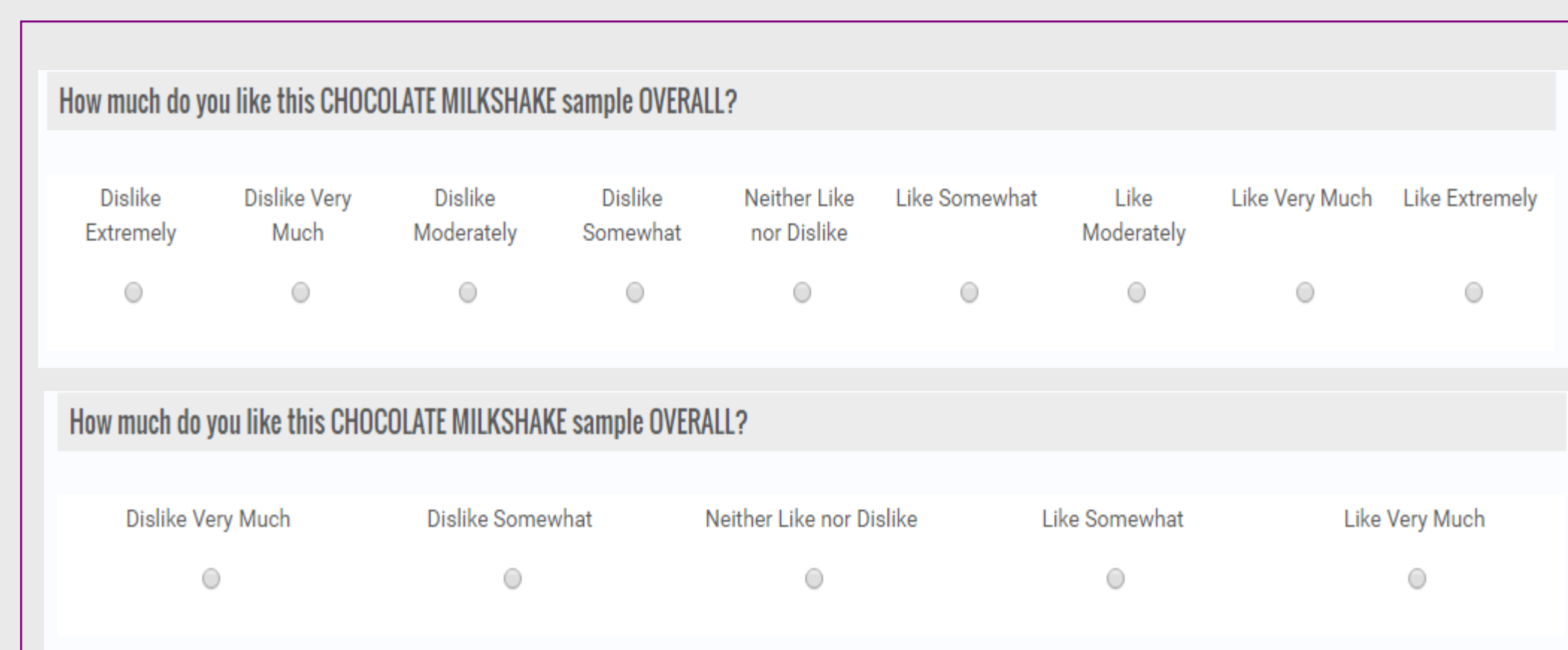The data were analyzed by Excel 2010, JMP 10, and RedJade.

Figure 1. 9-point hedonic scale vs. 5-point hedonic scale examples

Results and Discussion

Hedonic Scale Comparison

The linear regression   of all samples across the investigated liking attributes are shown in Figure 2.
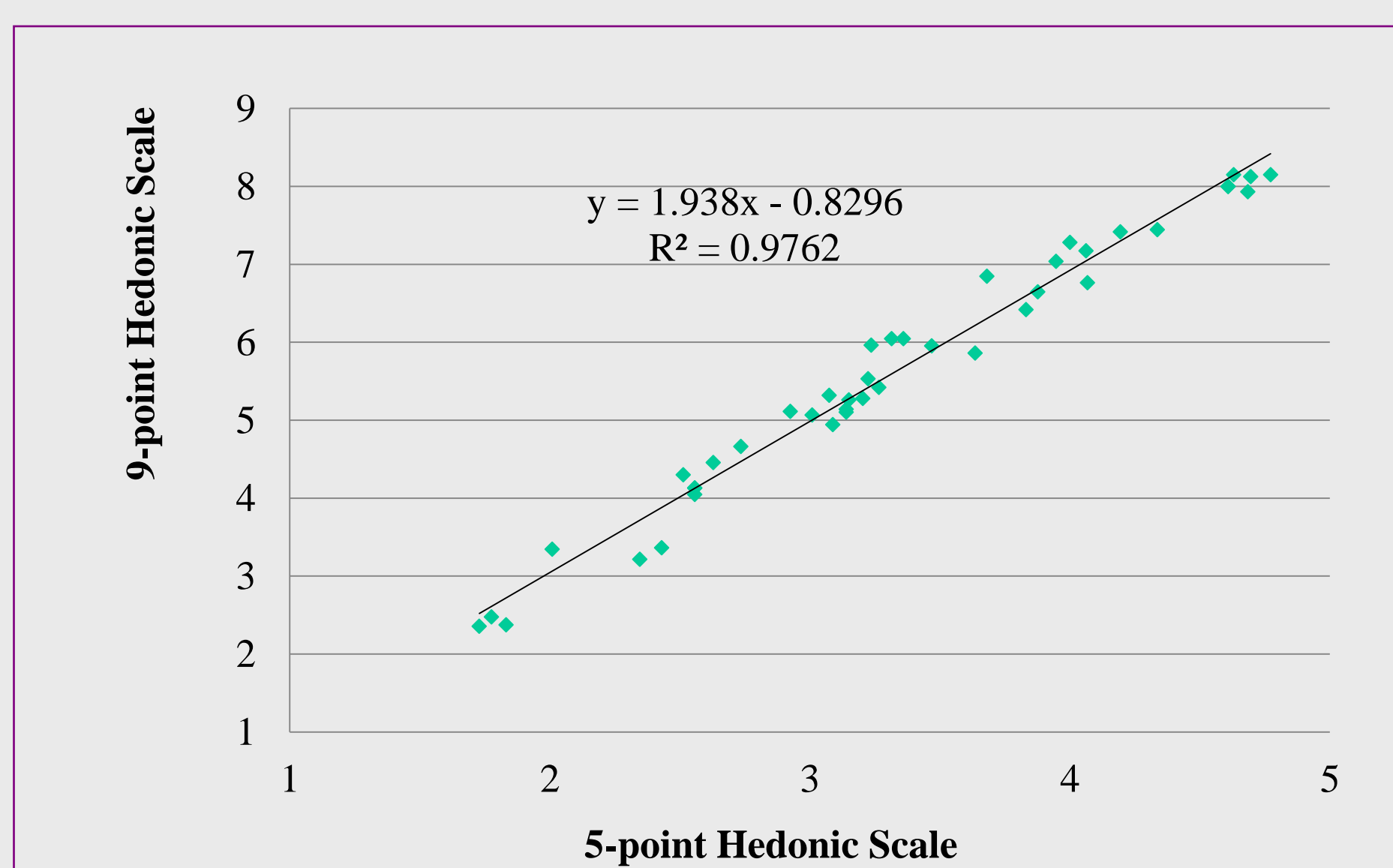

Figure 2. Regression Of 5-point Vs. 9-point Hedonic Scale

A high correlation (Figure 2) is observed between 5-point hedonic scale ("Dislike Very Much" to "Like Very Much") and 9-point scale ("Dislike Extremely" to "Like Extremely").   It means these two scales were exchangeable in the typical hedonic scale range.
Similar linear trends are found across all attributes when the data set is break down by liking attributes (Table 1).

When investigating the data from those who participated in both scale testing, parallel trends are observed (data not shown here). It demonstrates that these panelists were representative for the current subject pool.

Table 1. Linear Regressions For Liking Attributes

Attribute	Equation	R^2
Overall	y = 1.9015x - 0.7385	0.98
Appearance	y = 1.8394x - 0.589	0.97
Aroma	y = 1.7367x - 0.1757	0.99
Taste	y = 2.0037x - 1.0297	0.98
Texture	y = 1.9673x - 0.9941	0.98
Aftertaste	y = 2.0304x - 1.0852	0.97

Table 2 below demonstrates that the respondents were able to discriminate the differences between the aloe drink with 2g added sugar and 4g added sugar in terms of acceptance with the 9-point hedonic scale, while they could not with the 5-point hedonic scale.

Table 2. Liking Score Comparison For Cranberry Aloe Drink With 5-point And 9-point Hedonic Scale

Attribute	9-point Hedonic Scale			5-point Hedonic Scale		
	0g sugar	2g sugar	4g sugar	0g sugar	2g sugar	4g sugar
Overall	6.0a*	6.6b	7.2c	3.3a	4.0b	4.1b
Appearance	6.8a	7.1b	7.2b	4.1a	4.2ab	4.3b
Aroma	6.4a	6.8b	7.0b	3.8a	4.1b	4.1b
Taste	6.0a	6.6b	7.0c	3.2a	4.0b	4.0b
Texture	6.6a	7.1b	7.3c	3.9a	4.2b	4.2b
Aftertaste	6.0a	6.5b	7.0c	3.4a	3.9b	4b

* Witin each scale type and attribute, means sharing a common letter do not significantly differ at the 95% confidence level (Duncan's test).

Effects on Paired Preference

The paired preference test was conducted after the acceptance test for two sets of samples. No significant differences were found in preferences after the 5-point scale and 9-point scale tests for either samples set (one example shown as figure 3).
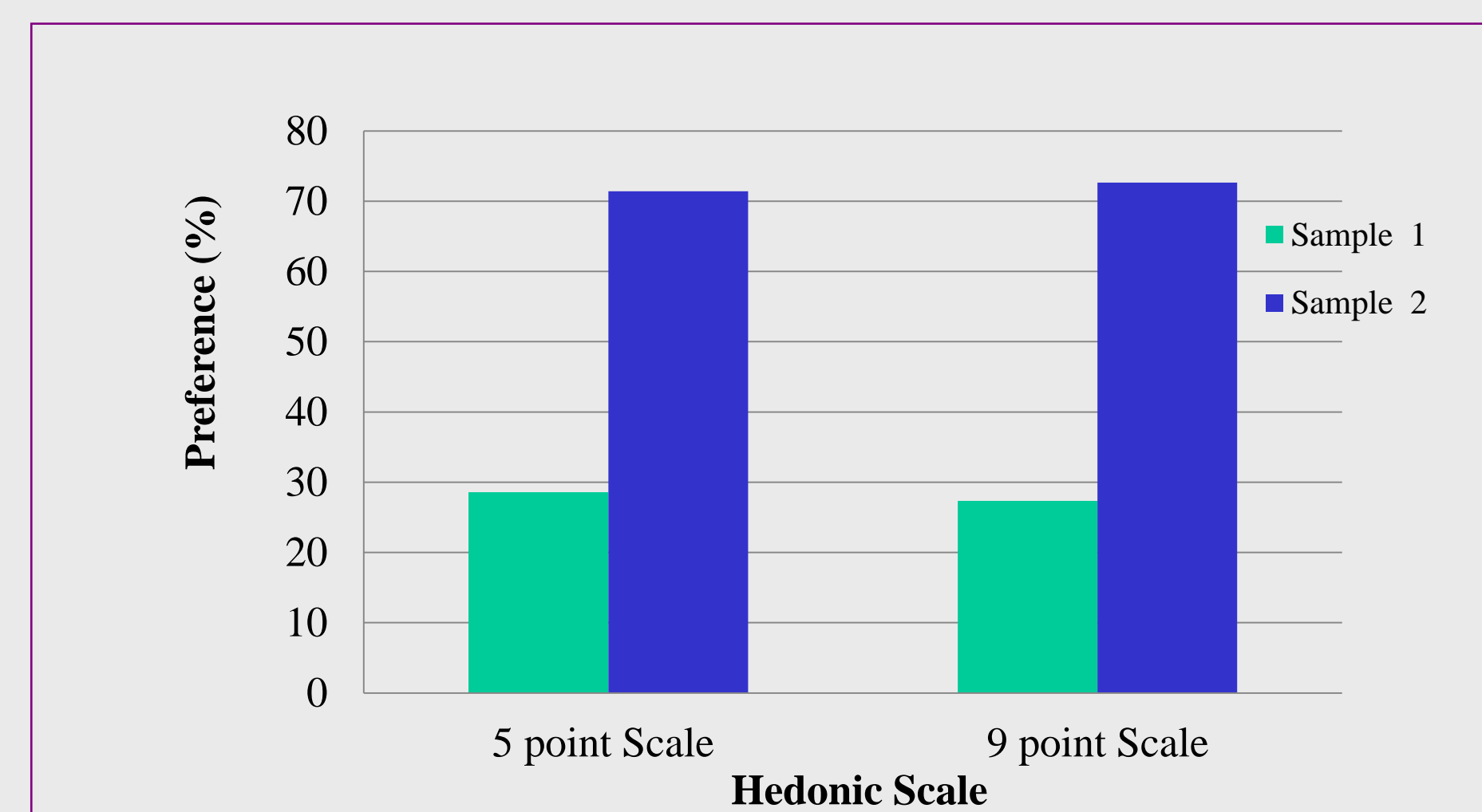

Figure 3. Paired Preference Comparison For Plant Protein Shake

Effects on Ranking

Figure 4 shows significant ($p<0.05$) differences in ranking were observed for all 3 aloe drink samples when testing with the 9-point hedonic scale. However, no significant difference was found between the samples with 2g sugar and 4g sugar with 5-point hedonic scale . The hedonic scales affected the ranking test very highly significantly ($p<0.001$).
As the ranking question was asked after the liking question, it is possible that the liking responses allowed respondents to more clearly identify rank the samples. . To avoid influence from the acceptance test, the ranking question could be moved to the beginning of the acceptance test questionnaire.
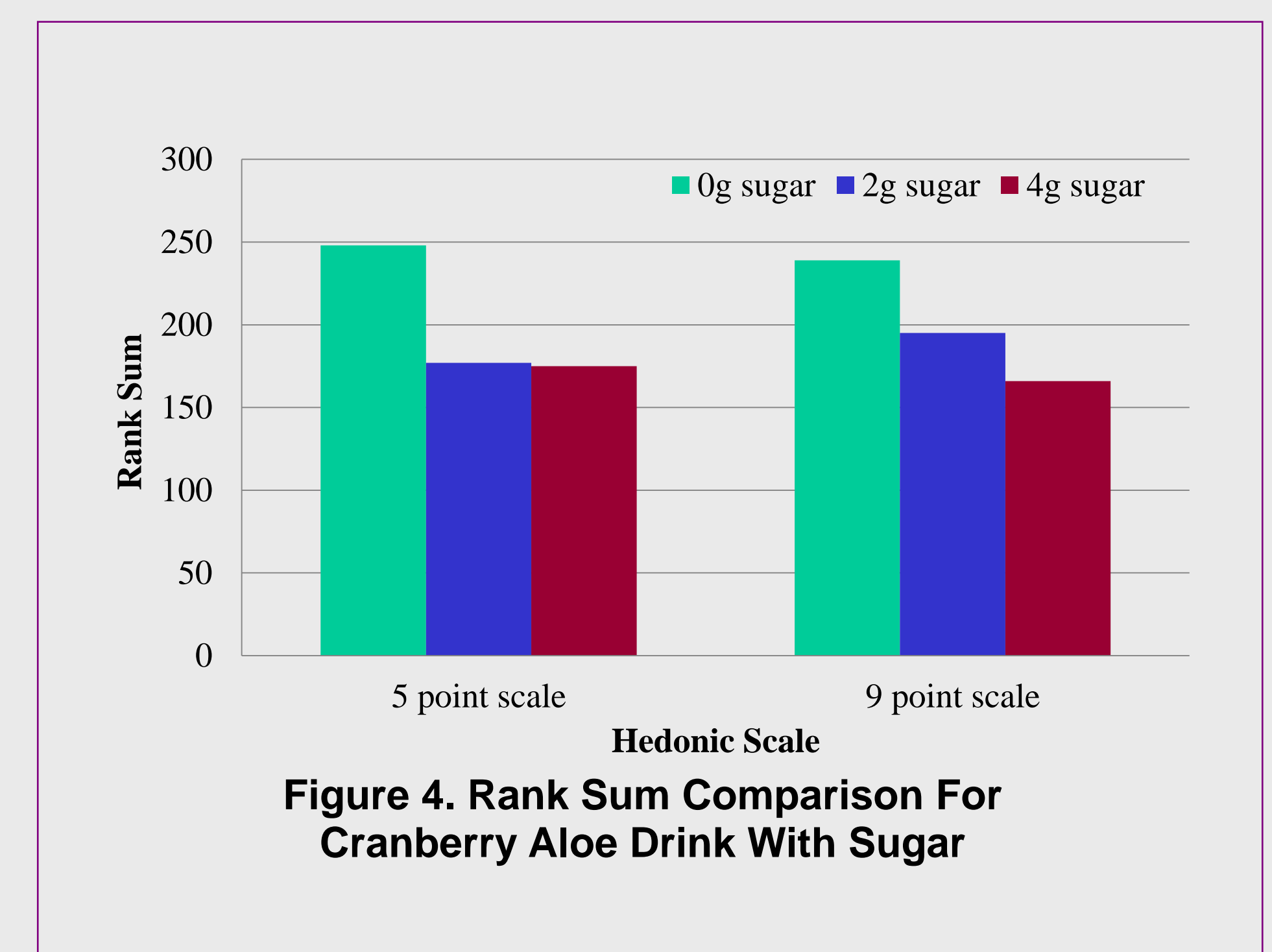

Figure 4. Rank Sum Comparison For Cranberry Aloe Drink With Sugar

Effects on JAR and Usage Frequency / Intent Questions

No significant ($p<0.05$) differences were found for the JAR or usage frequency / intent questions when testing with 5-point or the 9-point hedonic scales (data not shown here). This indicates panelists were consistent in responding to these questions regardless of hedonic scale type.

Conclusions

The 9-point and 5-point hedonic scales provide similar data across attributes and products, and can be used interchangeably. However, the 9-point scale is more discriminating than the 5-point, when comparing samples representing small differences. Although the 9-point hedonic scale is more complicated for respondents experienced with the 5-point scale, most were readily able to adopt it without any additional training. The 9-point hedonic scale will be beneficial to timely support the reformulation efforts and meet the consumers' trends.

References

1. A comparison of the labeled magnitude (LAM) scale, an 11-point category scale and the traditional 9-point hedonic scale , Harry T. Lawless, Richard Popper, Beverley J. Kroll', Food Quality and Preference, Volume 21, Issue 1, January 2010, Pages 4-12
2. Hedonic scaling: A review of methods and theory, Juyun Lim, Food Quality and Preference, Volume 22, Issue 6, January 2011, Pages 733-747
3. A comparison of the labeled magnitude scale and the 9-point hedonic scale and the examination of categorical behavior Harry T. Lawless, Dominique Sinopoli, Kathryn W. Chapmen,Journal of Sensory Studies, Volume 25, Issue 1, January 2010, Pages 54-66
4. http://www.globalfoodforums.com/food-news-bites/2016-food-trends/