

TASTE PANEL EVALUATIONS OF ICE CREAM SWEETENED WITH REBIANA

A REPORT FOR CARGILL

by

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¹ Rebiana has been established as the common or usual name for high-purity (97+% dry basis) rebaudioside A

STUDY DETAILS

TITLE	Taste Panel Evaluations Of Ice Cream Sweetened With Rebiana
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SPONSORS	Amy Boileau Scientific Regulatory Affairs Cargill Health & Nutrition Ralf Loeffelholz Rebiana Sales & Marketing Cargill Health & Nutrition
TESTING FACILITY	Cargill Health & Nutrition Cargill Office Center
STUDY DATES	5-13 th February 2009
STUDY DIRECTORS	For Connect Consulting:- Dr John C. Fry For Cargill Health & Nutrition:- Nese Yurttas Norris Sun
KEY CONTRIBUTORS	Cargill Health & Nutrition: Kari Biermann Vince Cavallini Tanya Schmidt Bryan Shiplett

SUMMARY

No-sugar-added vanilla ice cream was made with the current Food Standards Australia New Zealand (FSANZ) maximum use level of rebaudioside A (64 mg/kg steviol equivalent) and two higher levels (165 & 200 mg/kg steviol equivalent).

The ice creams were assessed by an untrained consumer panel (N=70-73) for sweetness on a just-about-right (JAR) scale and for overall liking.

It was found that the ice cream made with the current FSANZ maximum use level for rebaudioside A was:-

- not significantly differently liked
- rated not sweet enough by a very significant margin

when compared with one made with 165 mg/kg steviol equivalents rebaudioside A.

The ice cream made with the current FSANZ maximum use level for rebaudioside A was:-

- very significantly less liked
- rated not sweet enough by a very significant margin

when compared with one made with 200 mg/kg steviol equivalents rebaudioside A.

It was concluded that:-

- The current FSANZ maximum use level for rebaudioside A in ice cream is too low to achieve optimum sweetness.
- Use of 600 mg/kg rebaudioside A (200 mg/kg steviol equivalent) produces an ice cream of very significantly higher overall liking than one made with the current FSANZ maximum use level.
- Use of 600 mg/kg rebaudioside A (200 mg/kg steviol equivalent) produces an ice cream with a more balanced distribution of 'just about right' sweetness responses than one made with the current FSANZ maximum use level.

KEYWORDS

rebiana, ice cream, sensory analysis, taste panel, sweetness, liking, JAR, Australia, New Zealand, regulatory, use level, steviol glycoside, rebaudioside A

INTRODUCTION

Australia and New Zealand have recently permitted steviol glycosides as sweeteners in a range of foods and beverages. In some cases, the maximum use limits enacted were substantially lower than the optimum for best taste indicated by Cargill's applications development work. Cargill envisaged a need to request increased use levels for certain applications and asked Connect Consulting to organize a study to compare sensory quality of ice cream made at the current maximum use levels of rebaudioside A as specified in Food Standards Australia New Zealand (FSANZ) with ice cream employing higher concentrations of the sweetener.

For this study a no-added-sugar ice cream was used. Sensory analysis was by an untrained consumer panel asked to evaluate sweetness on a just-about-right (JAR) scale and overall liking.

OBJECTIVE

To compare consumer assessments of no-sugar-added ice cream sweetened with rebaudioside A at FSANZ maximum use levels and higher.

METHOD

MATERIALS, FORMULATIONS & PROCESS

A no-sugar-added vanilla ice cream was made with three concentrations of rebaudioside A, namely 195, 500 and 600 mg/kg. These concentrations expressed as steviol equivalents (as per the FSANZ regulations) are as follows²:-

Concentration rebaudioside A (mg/kg)	Steviol equivalent concentration (mg/kg) rounded
195	64
500	165
600	200

For details of formulation and process, see Appendix.

² FSANZ calculate the use levels of all steviol glycosides in terms of steviol equivalents. The relative molecular mass of steviol is 318.45, that of rebaudioside A is 967.01, hence unit mass of rebaudioside A provides 0.329 unit mass steviol equivalent.

SENSORY

Sample Description – Panel 1:

Sample ID	Description	Rebaudioside A (mg/kg)
Control	Vanilla ice cream (Skim milk, cream, maltodextrin, erythritol, non fat dry milk, natural flavor, stabilizer, and rebiana).	195
Sample A	Vanilla ice cream = Same as Control except for the amount of rebiana. (Skim milk, cream, maltodextrin, erythritol, non fat dry milk, natural flavor, stabilizer, and rebiana).	500

Sample Description – Panel 2:

Sample ID	Description	Rebaudioside A (mg/kg)
Control	Vanilla ice cream (Skim milk, cream, maltodextrin, erythritol, non fat dry milk, natural flavor, stabilizer, and rebiana).	195
Sample B	Vanilla ice cream = Same as Control except for the amount of rebiana. (Skim milk, cream, maltodextrin, erythritol, non fat dry milk, natural flavor, stabilizer, and rebiana).	600

Panel:

The panel consisted of Cargill Head Quarters Office Center (Wayzata, MN, USA) Employees who are willing to taste vanilla ice cream.

Summary panel details:-

Number of panellists Panel 1	70
Number of panellists Panel 2	73
Sample serving temperature	-18 to -20°C
Serving size	about 1oz / 28g
Serving container	2oz plastic soufflé cup, lidded
Test date Panel 1	Feb 11, 2009
Test date Panel 2	Feb 12, 2009

Methods:

Ice cream samples were scooped using # 30 scoop (about 1oz). The samples were served in a 2oz. soufflé cups with lids. Panellists were recruited via email for willingness to taste vanilla ice cream. They were instructed to taste sufficient amount of sample to evaluate for Overall Liking on a 9-point hedonic scale (9 = like extremely, 1 = dislike extremely) and Sweetness (using a Just About Right 5-point scale with 'just about right' = 3). They were given plastic spoons to use for tasting, and a cup of with filtered water for rinsing in between samples. Two samples were served in a balanced randomized order. Data was analyzed by ANOVA using SPSS statistical software.

RESULTS

PANEL 1

Control = 195 mg/kg rebaudioside A

Sample = 500 mg/kg rebaudioside A

Attribute	Control Score	Sample Score	P value	Significance
Overall liking	6.69	6.87	0.384	not significant
Sweetness JAR	2.44	2.84	<<0.01	highly significant

Sweetness JAR distribution:-

Reb. A level	Number of responses				Percentage responses		
	Not enough	Just about right	Too much	Total responses	Not enough*	Just about right	Too much
195 mg/kg	32	37	1	70	46%	53%	1%
500 mg/kg	19	43	8	70	27%	61%	11%

* Results very significantly different, $P < 0.01$ i.e. a significant number of panellists indicated not enough sweetness.

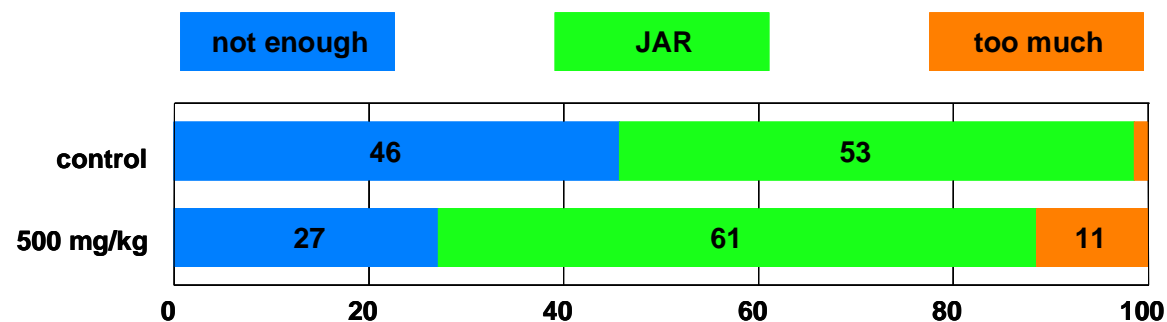


Figure 1. Distribution of JAR results for control and 500 mg/kg.

Ideal is maximum width of JAR (green) and JAR approximately central with equal

responses for 'not enough' and 'too much' either side.

PANEL 2

Control = 195 mg/kg rebaudioside A

Sample = 600 mg/kg rebaudioside A

Attribute	Control Score	Sample Score	P value	Significance
Overall liking	5.79	6.84	<<0.01	highly significant
Sweetness JAR	2.27	2.96	<<0.01	highly significant

Sweetness JAR distribution:-

Reb. A level	Number of responses				Percentage responses		
	Not enough	Just about right	Too much	Total responses	Not enough*	Just about right	Too much
195 mg/kg	45	28	0	73	62%	38%	0%
600 mg/kg	16	45	12	73	22%	62%	16%

* Results very significantly different, $P < 0.01$ i.e. a significant number of panellists indicated not enough sweetness.

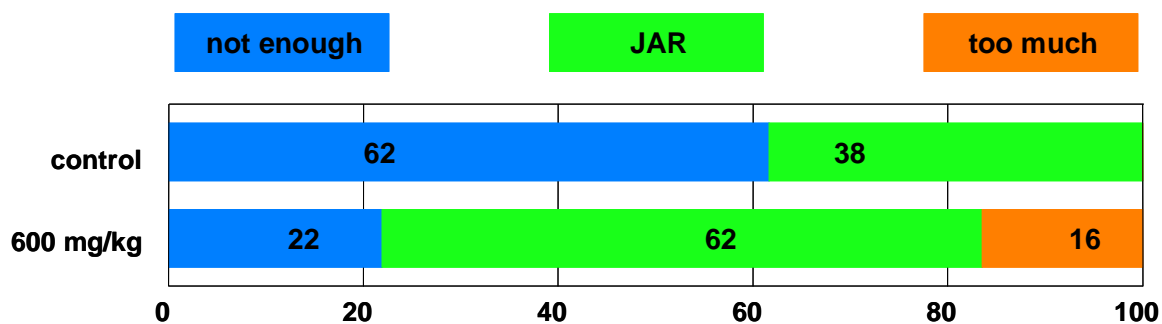


Figure 2. Distribution of JAR results for control and 600 mg/kg.

Ideal is maximum width of JAR (green) and JAR approximately central with equal responses for 'not enough' and 'too much' either side.

DISCUSSION

500 mg/kg Rebaudioside A sample

This sample showed no significant difference in overall liking from the control formulated at the current FSANZ maximum use level of rebaudioside A. However the panel rated the sweetness of the control as 'not enough' by a highly significant margin ($P < 0.01$).

This indicates that the current maximum use level does not provide sufficient sweetness.

The distribution of JAR responses shows that the formulation of the sample at 500 mg/kg gives a better balance than the control (i.e. the JAR area is more central than that of the control, with a better matching of the 'not enough' and 'too much' responses on either side). However, the ideal balance would be approximately equal percentage scores for 'not enough' and 'too much'. The 500 mg/kg sample does not have this ideal balance, and still shows more than twice as many 'not enough sweetness' responses as 'too much'.

600 mg/kg Rebaudioside A sample

This sample showed highly significant differences ($P < 0.01$) in both overall liking and sweetness from the control formulated at the current FSANZ maximum use level of rebaudioside A. The panel rated the control as very significantly lower in liking, and also rated the sweetness of the control as 'not enough' by a highly significant margin.

This indicates that the current maximum use level does not provide sufficient sweetness and the control product is less well liked than one made with 600 mg/kg rebaudioside A.

The distribution of JAR responses shows that the formulation of the sample at 600 mg/kg gives a much better balance than the control, and an improved balance compared with that of the 500 mg/kg sample.

CONCLUSIONS

1. The current FSANZ maximum use level for rebaudioside A in ice cream is too low to achieve optimum sweetness.
2. Use of 600 mg/kg rebaudioside A (200 mg/kg steviol equivalent) produces an ice cream of very significantly higher overall liking than one made with the current FSANZ maximum use level.
3. Use of 600 mg/kg rebaudioside A (200 mg/kg steviol equivalent) produces an ice cream with a more balanced distribution of 'just about right' sweetness responses than one made with the current FSANZ maximum use level.

END

APPENDIX

ICE CREAM FORMULATION

A 16% fat, no-sugar-added ice cream was made with three addition levels of rebiana (195, 300, 500, 600 mg/kg).

The formulae are shown below.

Abbreviations:-

mf milk fat

nfdm non-fat dry milk, same as msnf

msnf milk solids non-fat, same as nfdm

with 195 mg/kg rebiana

Control			SOLIDS	MSNF	FAT	AMOUNT	%WT	Total Milk Fat	Total Solids	Total MSNF
INGREDIENT	Supplier	Lot #				in Grams		in Grams	in Grams	in Grams
Skim Milk .02% mf	Organic Valley	retail	9.00%	8.88%	0.02%	2414.134	40.2356%	0.48	217.27	214.38
Cream	Organic Valley	retail	45.40%	5.40%	40.00%	2394.923	39.9154%	957.97	1087.29	129.33
Nfdm (low heat)	Dairy America	7332010004	97.00%	96.78%	0.22%	263.7626	4.3960%	0.58	255.85	255.27
Rebiana*	Cargill	DR0807038	99.00%	0.00%	0.00%	1.1805	0.0197%	0.00	1.17	0.00
Erythritol	Cargill	08J201BP952	99.00%	0.00%	0.00%	306	5.1000%	0.00	302.94	0.00
Maltodextrin 10DE	Cargill	H8D332	95.00%	0.00%	0.00%	559.98	9.3330%	0.00	531.98	0.00
Vanilla flavor 100-00578	Cargill	1000457405	0.00%	0.00%	0.00%	30	0.5000%	0.00	0.00	0.00
Daritech FR 368	Cargill	lab blended	99.00%	0.00%	0.00%	30	0.5000%	0.00	29.70	0.00

5999.98 total mix 6000 100.000%

Total MF 15.98%

Total MSNF 9.98%

total solids 40.44%

*Adjusted for moisture

with 500 mg/kg rebiana

Control			SOLIDS	MSNF	FAT	AMOUNT	%WT	Total Milk Fat	Total Solids	Total MSNF
INGREDIENT	Supplier	Lot #				in Grams		in Grams	in Grams	in Grams
Skim Milk .02% mf	Organic Valley	retail	9.00%	8.88%	0.02%	2412.334	40.2056%	0.48	217.11	214.22
Cream	Organic Valley	retail	45.40%	5.40%	40.00%	2394.923	39.9154%	957.97	1087.29	129.33
Nfdm (low heat)	Dairy America	7332010004	97.00%	96.78%	0.22%	263.7626	4.3960%	0.58	255.85	255.27
Rebiana*	Cargill	DR0807038	99.00%	0.00%	0.00%	3.026922	0.0504%	0.00	3.00	0.00
Erythritol	Cargill	08J201BP952	99.00%	0.00%	0.00%	306	5.1000%	0.00	302.94	0.00
Maltodextrin 10DE	Cargill	H8D332	95.00%	0.00%	0.00%	559.98	9.3330%	0.00	531.98	0.00
Vanilla flavor 100-00578	Cargill	1000457405	0.00%	0.00%	0.00%	30	0.5000%	0.00	0.00	0.00
Daritech FR 368	Cargill	lab blended	99.00%	0.00%	0.00%	30	0.5000%	0.00	29.70	0.00
			6000	total mix		6000	100.000%			
				Total MF		15.98%				
				Total MSNF		9.98%				
				total solids		40.46%				
*Adjusted for moisture										

*Adjusted for moisture

with 600 mg/kg rebiana

Control			SOLIDS	MSNF	FAT	AMOUNT	%WT	Total Milk Fat	Total Solids	Total MSNF
INGREDIENT	Supplier	Lot #				in Grams		in Grams	in Grams	in Grams
Skim Milk .02% mf	Organic Valley	retail	9.00%	8.88%	0.02%	2411.6736	40.1946%	0.48	217.05	214.16
Cream	Organic Valley	retail	45.40%	5.40%	40.00%	2394.9228	39.9154%	957.97	1087.29	129.33
Nfdm (low heat)	Dairy America	7332010004	97.00%	96.78%	0.22%	263.76264	4.3960%	0.58	255.85	255.27
Rebiana*	Cargill	DR0807038	99.00%	0.00%	0.00%	3.632304	0.0605%	0.00	3.60	0.00
Erythritol	Cargill	08J201BP952	99.00%	0.00%	0.00%	306	5.1000%	0.00	302.94	0.00
Maltodextrin 10DE	Cargill	H8D332	95.00%	0.00%	0.00%	559.98	9.3330%	0.00	531.98	0.00
Vanilla flavor 100-00578	Cargill	1000457405	0.00%	0.00%	0.00%	30	0.5000%	0.00	0.00	0.00
Daritech FR 368	Cargill	lab blended	99.00%	0.00%	0.00%	30	0.5000%	0.00	29.70	0.00
			5999.971344	total mix		6000	100.000%			
					Total MF	15.98%				
					Total MSNF	9.98%				
					total solids	40.47%				
*Adjusted for moisture										

*Adjusted for moisture

ICE CREAM PROCESS

The same process was used for each ice cream, namely:-

- 1.) Blend all dry ingredients (mixture A).
- 2.) Mix cream and skim milk together (mixture B).
- 3.) Blend A and B together and hydrate for 15 minutes.
- 4.) Heat to 130 ° F.
- 5.) Homogenize to 2000 psi.
- 6.) Heat to 190° F and hold for 1 minute.
- 7.) Cool to 40° F, and hold over night at refrigerated temperature.
- 8.) Add vanilla flavor, and transfer to ice cream freezer.
- 9.) Package.
- 10.) Store at -30° F for 24 hours to harden.
- 11.) Temper to 0° F for 24 hours before serving.

END