

Supplementary S1: Thailand Healthier Choice Nutritional Labelling Criterion and Its Food Category and Subcategory (update in April 2023 - 14 food categories)

Food category	Food sub-category	Nutritional criteria	
1. NON-ALCOHOLIC BEVERAGES	1. Fruit juice, vegetable juice 100%	Total Sugar	≤ 12 gr per 100 ml and ≤ 18 gr per package
		Sodium	≤ 100 mg per 100 ml
		Dietary fiber	≥ 0.75 gr per 100 ml
	2. Fruit juices/ Vegetable juices, soft drinks, and sweetened beverages with various flavors	Total Sugar	≤ 6 gr per 100 ml and ≤ 18 gr per package. One serving is not more than 150% of the reference serving size and the package size is not more than 500 ml.
		Sodium	≤ 40 mg per 100 ml ≤ 100 mg per 100 ml, apply with tomato juice that is greater than or equal to 90%.
		Total Energy	≤ 40 kcal per 100 ml ≤ 24 kcal per 100 ml, in case the ingredient contains sugar and sugar substitutes ≤ 10 kcal per 100 ml, in case the ingredient contains only sugar substitutes
	3. Cereal milk, soy milk	Total sugar	≤ 6 gr per 100 ml and ≤ 18 gr per package. One serving is not more than 150% of the reference serving size and the package size is not more than 500 ml.
		Total fat	≤ 3.5 gr per 100 ml
		Saturated fat	≤ 1 gr per 100 ml
		Sodium	≤ 40 mg per 100 ml
	4. Chocolate beverages, cocoa, malt extracts, and constituents of milk or protein	Total Sugar	≤ 6 gr per 100 ml and ≤ 18 gr per package. One serving is not more than 150% of the reference serving size and the package size is not more than 500 ml.
		Total Fat	≤ 1 gr per 100 ml and ≤ 3 gr per package. One serving is not more than 150% of the reference serving size
		Sodium	≤ 100 mg per 100 ml
		Total energy	≤ 60 kcal per 100 ml ≤ 40 kcal per 100 ml, in case the ingredient contains sugar and sugar substitutes
	5. Instant tea	Total Sugar	≤ 6 gr per 100 ml and ≤ 18 gr per package. One serving is not more than 150% of the reference serving size and the package size is not more than 500 ml.
		Total Fat	≤ 0.6 gram per 100 ml and ≤ 1.8 grams per package. One serving is not more than 150% of the reference serving size
		Sodium	≤ 40 mg per 100 ml
		Total energy	≤ 40 kcal per 100 ml ≤ 24 kcal per 100 ml, in case the ingredient contains sugar and sugar substitutes ≤ 10 kcal per 100 ml, in case the ingredient contains only sugar substitutes
	6. Instant coffee	Total Sugar	≤ 6 gr per 100 ml and ≤ 18 gr per package. One serving is not more than 150% of the reference serving size and the package size is not more than 500 ml.

		Total Fat	≤ 1 gr per 100 ml and ≤ 3 gr per package. One serving is not more than 150% of the reference serving size
		Sodium	≤ 100 mg per 100 ml
		Total energy	≤ 60 kcal per 100 ml ≤ 40 kcal per 100 ml, in case the ingredient contains sugar and sugar substitutes
2. SEASONING SAUCES	7. Fish sauce	Sodium	≤ 6,000 mg per 100 ml.
	8. Seasoning, soy sauce	Sodium	≤ 5,000 mg per 100 ml.
	9. Black soy sauce	Sodium	≤ 5,000 mg per 100 ml.
	10. Sweet soy sauce	Sodium	≤ 2,000 mg per 100 gr.
	11. Other Sweet sauce	Total sugar	≤ 40 g per 100 gr
		Sodium	≤ 900 mg per 100 gr
	12. Oyster sauce	Total sugar	≤ 30 gr per 100 gr
		Sodium	≤ 2,000 mg per 100 gr
	13. Chili sauce	Total sugar	≤ 11 gr per 100 gr
		Sodium	≤ 750 mg per 100 gr
	14. Tomato sauce	Total sugar	≤ 12 gr per 100 gr
		Sodium	≤ 750 mg per 100 gr
	15. Other sauces for dipping	Total sugar	≤ 17 gr per 100 gr
		Sodium	≤ 1,300 mg per 100 gr
3. DAIRY PRODUCTS	16. Other Western style sauces	Total sugar	≤ 14 gr per 100 gr
		Sodium	≤ 800 mg per 100 gr
	17. Suki sauce	Total sugar	≤ 16 gr per 100 gr
		Sodium	≤ 1,500 mg per 100 gr
	18. Fresh milk, powdered milk	Total sugar	≤ 15 gr per 100 gr
		Total fat	No added sugar
	19. Flavored Milk Product	Total Sugar	≤ 4 gr per 100 ml, except if one serving contains more than 150% of the reference serving size, must not have added sugar and total fat not more than 12 grams.
		Total Sugar	≤ 8 gr per 100 ml, except if one serving contains more than 150% of the reference serving size, total sugar must not exceed 24 gr.
	20. Cultured Milk (regular yoghurt, yoghurt drinks)	Total fat	≤ 3.5 g per 100 ml, except if one serving contains more than 150% of the reference serving size, total fat must not more than 10.5 g. Notes: One reference serving size of milk and ready-to-drink milk products is 200 ml. 150% of one reference serving size of milk and dairy products or RTD milk equal to 300 ml.
		Total Sugar	≤ 5 gr per 100 ml, except if one serving contains more than 150% of the reference serving size, total sugar must not exceed 11.25 g. Notes: One reference serving size of milk and ready-to-drink milk products is 150 ml. 150% of one reference serving size of semi-liquid cultured milk, semi-solid cultured milk and ready-to-drink cultured milk equal to 225 ml.
4. INSTANT FOOD	21. Powdered milk products		Consider giving nutrition symbols only to recipes that have a brewing method with the addition of water only.
	22. Instant noodle	Sodium	≤ 1,000 milligrams per 50 grams for packaging with no more than 70 g per serving, except if one serving is more than 70 g, shall contain no more than 1,400 mg of sodium per serving.
	23. Rice porridge or congee	Sodium	≤ 1,000 milligrams per 50 grams for packaging with no more than 50 g per serving, except if one serving is more than 50 g, shall contain no more than 1,000 mg of sodium per serving.
		Total fat	≤ 4 g per 100 g prepared product

	24. Plain soup and concentrate soup (cube, powder, dried)	Sodium	≤ 240 mg per 100 g prepared product Note: This criterion means the soup should be in powdered or cubed form and added with water for immediate consumption, the product shall does not include soup cubes used as raw materials for cooking
5. SNACK	25. Snacks not included nuts and beans (baked, fried, salted or flavored)	Total energy Saturated fat Total sugar Sodium	≤ 150 kcal per serving ≤ 6 gr per 100 gr ≤ 7 gr per 100 gr ≤ 500 mg per 100 gr
	26. Beans, nuts and seed	Total energy Total fat Total Sugar Sodium	≤ 200 kcal/Serving ≤ 0.3% (no added oiled, except to enhance flavor) No added sugar ≤ 100 mg per 100 gr
6. ICE CREAM	27. Ice cream all kinds	Total energy Saturated fat Total Sugar Sodium	≤ 130 kcal per serving ≤ 5 gr per 100 gr ≤ 20 gr per 100 gr ≤ 100 mg per 100 gr
7. FAT AND OIL	28. Margarine	Saturated fat Sodium	≤ 27gr per 100 gr ≤ 100 mg per 100 gr
	29. Mayonnaise, Salad dressing and Sandwich spread	Total energy Saturated fat Total Sugar Sodium	≤ 350 kcal per 100 gr ≤ 4 gr per 100 gr ≤ 15 gr per 100 gr ≤ 750 mg per 100 gr
8. BREAD	30. Bread without loaves	Total sugar Total fat Sodium Dietary fiber	≤ 6 gr per 100 gr ≤ 5 gr per 100 gr ≤ 450 gr per 100 gr ≥ 3 mg per 100 gr
9. BREAKFAST CEREAL	31. Breakfast Cereal	Total sugar Saturated fat Sodium Dietary fiber	≤ 20 gr per 100 gr ≤ 3 gr per 100 gr ≤ 300 gr per 100 gr ≥ 6 mg per 100 gr
10. BAKERY PRODUCTS	32. Cookies and cakes all kinds	Total energy Total sugar Total fat Sodium Dietary fiber	≤ 110 kcal per serving. Reference and one serving shown on the label. ≤ 20 gr per 100 gr ≤ 22 gr per 100 gr ≤ 300 gr per 100 gr ≥ 3 mg per 100 gr
11. SMALL MEAL	33. Salty/meat fillings such as sandwiches, hamburgers, stuffed buns and buns	Total energy Total sugar Total fat Sodium	≤ 150-250 kcal per serving ≤ 2.5 gr per 100 kcal ≤ 3.25 gr per 100 kcal ≤ 175 mg per 100 kcal
	34. Sweet filling/cream filling/custard/jam/fruit such as sandwiches, stuffed bread and buns	Total energy Total sugar Total fat Sodium	≤ 150-250 kcal per serving ≤ 3.75 gr per 100 gr ≤ 3.25 gr per 100 gr ≤ 150 mg per 100 gr
12. FISH AND OTHER AQUATIC PRODUCTS	35. Fish fillets in mineral water and brine	Total Sugar Total Fat Sodium	No added sugar No added oil ≤ 350 mg per 100 gr
	36. Fish fillets in oil	Total Sugar Total fat Sodium	No added sugar ≤ 5 gr per 100 gr ≤ 350 mg per 100 gr
	37. Fish fillet in tomato and chili sauce	Total sugar Total fat Sodium Total sugar	≤ 2 gr per 100 gr ≤ 5 gr per 100 gr ≤ 400 mg per 100 gr ≤ 5 gr per 100 gr

13. MEAT PRODUCTS	38. All kinds of sausages, meat ball (including Vietnamese sausages, chicken ball etc.)	Total Sugar	2.5 gr per 100 gr
		Sodium	≤ 550 mg per 100 gr (Phase 1)
		Total Fat	≤ 10 gr per 100 gr or 10-15 gr per 100 gr if the proportion of saturated fatty acids must be 45% of the total fat
	39. Ham	Total Sugar	2.5 gr per 100 gr
		Sodium	≤ 900 mg per 100 gr
		Total Fat	≤ 10 gr per 100 gr
	40. Seasoned meat	Total Sugar	2.0 gr per 100 gr
		Sodium	≤ 450 mg per 100 gr
		Total Fat	≤ 8 gr per 100 gr
	41. Meat slices/ sticks/ crispy, meat shredded	Total Sugar	25 gr per 100 gr
		Sodium	≤ 1,000 mg per 100 gr
		Total Fat	≤ 8 gr per 100 gr

14. PREPARED MEAL: Ready-to-eat meal includes food that is consumed as a main dish of complete nutrients especially calories, carbohydrate, protein, and fat. Ready-to-eat meals in both frozen and chilled forms usually provide 250-500 kcal per serving. Qualified food products in this category must meet all following criteria: (1) Having energy between 250-500 kilocalories per serving; (2) Fat, saturated fat, sugar, and sodium score must be higher than 0; (3) Total scores must be 20 or more out of 40. Scores of nutrients per 100 kcal are shown in the below table.

Type of nutrient	Unit	Score					
		0	1	2	3	4	5
Protein	g	< 0.50, > 25*	0.50 – 1.00	1.01 – 1.50	1.51 – 2.00	2.01 – 2.50	> 2.50, ≤ 25*
Calcium	mg	< 8, > 750*	8 – 16	17 – 24	25 – 32	33 – 40	> 40, ≤ 750*
Iron	mg	< 0.14, > 11.25*	0.14 – 0.28	0.29 – 0.42	0.43 – 0.56	0.57 – 0.70	> 0.70, ≤ 11.25*
Fiber	g	< 0.25	0.25 – 0.50	0.51 – 0.75	0.76 – 1.00	1.01 – 1.25	> 1.25
Total Fat	g	> 3.25	2.94 – 3.25	2.62 – 2.93	2.30 – 2.61	1.98 – 2.29	≤ 1.97
Saturated Fat	g	> 1.00	0.96 – 1.00	0.91 – 0.95	0.86 – 0.90	0.81 – 0.85	≤ 0.80
Total Sugar	g	> 1.25	1.01 – 1.25	0.76 – 1.00	0.51 – 0.75	0.25 – 0.50	< 0.25
Sodium (Phase 1)	mg	< 75, > 175	156 – 175	136 – 155	116 – 135	96 – 115	75 – 95

* Amount per one serving

Supplementary S2: Timeline of Thailand Healthier Choice nutritional labelling Food Category Expansion (update in April 2023 - 14 food categories)

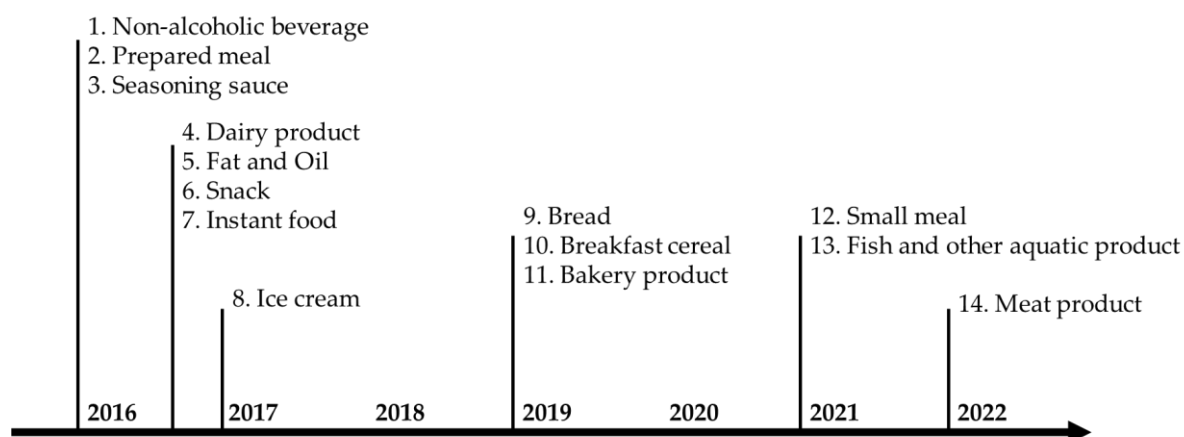


Figure S1. Timeline of THCL Food Category Expansion

Supplementary S3: Food category and subcategory in Mintel Global New Product Database (GNPD)

Food category	Sub-category
1. Bakery products	1. Sweet Biscuits/Cookies
	2. Bread & Bread Products
	3. Savory Biscuits/Crackers
2. Breakfast cereals	4. Cold Cereals
	5. Hot Cereals
3. Carbonated soft drinks	6. Carbonated soft drinks
4. Dairy	7. Plant Based Drinks (Dairy Alternatives)
	8. Flavored Milk
	9. White Milk
	10. Drinking Yogurt & Liquid Cultured Milk
5. Desserts & Ice Cream	11. Dairy-Based Ice Cream & Frozen Yogurt
	12. Plant Based Ice Cream & Frozen Yogurt (Dairy Alternatives)
	13. Water Based Ice Lollies, Pops & Sorbets
6. Hot Beverages	14. Malt & Other Hot Beverages
	15. Coffee
	16. Tea
7. Juice Drinks	17. Nectars
	18. Fruit/Flavoured Still Drinks
	19. Juice
8. Meal and Meal Centers	20. Prepared Meals
	21. Instant Noodles
	22. Instant Rice
9. Nutritional Drinks & Other Beverages	23. Nutritional & Meal Replacement Drinks
10. RTDs (Ready to Drinks)	24. RTD (Iced) Tea
	25. RTD (Iced) Coffee
11. Sauces & Seasonings	26. Table Sauces
	27. Dressings & Vinegar
12. Snacks	28. Bean-Based Snacks
	29. Rice Snacks
	30. Fruit Snacks
	31. Potato Snacks
	32. Meat Snacks
	33. Popcorn
	34. Corn-Based Snacks
	35. Vegetable Snacks
	36. Nuts
	37. Cassava & Other Root-Based Snacks
	38. Snack Mixes
	39. Snack/Cereal/Energy Bars
	40. Wheat & Other Grain-Based Snacks
13. Soup	41. Wet Soup
14. Sports and Energy Drinks	42. Energy Drinks
	43. Sports Drinks
15. Water	44. Flavored Water
	45. Water

Supplementary S4: Food category using in the present study and its definition

No.	Food Category	Definition
1	Bakery products	Bakery products, which include rolls, cookies, pies, pastries, and muffins, except bread which are usually prepared from flour or meal derived from some form of grain.
2	Bread	Bread is a kind of food made of flour or meal that has been mixed with milk or water, made into a dough or batter, with or without yeast or other leavening agent, and baked. This category includes bread without loaves.
3	Breakfast cereal	Food made from processed grains, such as maize, oats, wheat or corn, rice, is usually eaten for breakfast with milk and sometimes sugar. This category includes both hot and cold cereals such as muesli, granola, flakes etc.
4	Dairy product	Dairy products are defined as milk and any of the foods made from milk, including fresh milk, yogurt, condensed and dried milk. This category excludes other dairy-based food products such as butter, cheese, ice cream
5	Fats and oil	This category includes dressing, which is a type of sauce prepared for salads that usually has a vinegar and oil base with the addition of herbs and spices
6	Ice-cream	Ice-cream is a mixture of dairy ingredients (e.g. milk, cream, nonfat milk), ingredients for sweetening and flavoring, that has been frozen into a soft, creamy delight. Water-based ice lollies, pops & sorbets are included in this category.
7	Instant food	Are convenience foods which require minimal preparation, typically just adding water or milk. This food category includes instant noodle and instant porridge
8	Instant tea and coffee	Coffee and tea, where milk is not the primary ingredient. May or may not be carbonated. Include powdered, ground, bags, or ready-to-drink coffee/ tea.
9	Malted, and chocolate drink	Beverages which contain chocolate and/or cocoa as the main and/or predominant ingredient and/or flavor. Include powdered, ground, or ready-to-drink malted beverages (hereafter referred to as chocolate malted drinks)
10	Plant-based milk substitute	Non-dairy beverages consist primarily of liquid extracted from plants for flavoring and aroma. Include grains (cereal, rice), legumes (peas, soy), and other varieties of seeds and nuts.
11	Prepared meal	Are defined as pre-prepared or ready-to-eat main courses, supplied in the container under frozen or chilled form, requiring no further ingredients or preparation required other than heating
12	Seasoning/ Sauces	Substances are added to other foods to enhance their flavor and smell. This category includes all kinds of sauces such as dark sauces, meal sauces, emulsified sauces, other sauces (water-based) etc.
13	Small meal	Are defined as pre-prepared or ready-to-eat light meals such as hors d'oeuvres or canapes. This food category includes both salty/meat fillings such as sandwiches, hamburgers, stuffed buns and sweet /cream filling such as sandwiches, stuffed bread and buns etc.
14	Snack (starch- and meat-based)	Are a small amount of food that is eaten between meals, or a very small meal, formed under packaged and/or processed foods, which include tortilla chips, corn chips, potato chips, extruded products (direct expansion and pellets), pork rinds, pretzels, popcorn etc.
15	Snacks (nut- and bean-based)	Are a small amount of food that is eaten between meals, or a very small meal, formed under packaged and/or processed foods, which include legumes, nut, seed and bean.
16	Soups	Soups consist of liquid soups, and/or canned soups. It can be partially dehydrated, or condensed, containing some liquid content.
17	Soft drink	Non-alcoholic beverages include carbonated drinks, energy drink, flavored water, sport drinks.
18	Vegetables and fruit juice	All fruit and vegetable juice that includes both non-100% and 100% fruit and vegetable juice.

Supplementary S5: Linear equation and R-squared value of uptake of Thailand Healthier Choice nutrition labelling per total newly launched product and eligible product

Food category	Trend of annual uptake per total product*	Trend of annual uptake per eligible product**
Bakery products	$y = 0.0246x + 0.0575$; $R^2 = 0.0171$	$y = 0.7143x + 1.6667$; $R^2 = 0.0171$
Bread	$y = 0.8963x - 1.5585$; $R^2 = 0.8359$	$y = 10.286x - 16$; $R^2 = 0.6171$
Breakfast cereal	$y = 0.7472x - 1.5095$; $R^2 = 0.6627$	$y = 4.2857x - 8.5185$; $R^2 = 0.6187$
Dairy products	$y = 4.8297x - 2.5405$; $R^2 = 0.7326$	$y = 9.9002x - 4.2153$; $R^2 = 0.757$
Fats and oils	$y = 5.4762x - 11.296$; $R^2 = 0.7024$	$y = 15.714x - 30$; $R^2 = 0.4939$
Ice-cream	$y = 4.3809x - 5.9176$; $R^2 = 0.9402$	$y = 15.807x - 15.786$; $R^2 = 0.8909$
Instant food	$y = 9.6739x - 13.138$; $R^2 = 0.9203$	$y = 13.302x - 15.927$; $R^2 = 0.9312$
Instant tea and coffee	$y = 7.8262x - 10.022$; $R^2 = 0.9707$	$y = 10.841x - 12.695$; $R^2 = 0.9773$
Malted, and chocolate drink	$y = 6.5442x - 7.7831$; $R^2 = 0.8723$	$y = 8.0213x - 7.6628$; $R^2 = 0.7936$
Plant-based milk substitute	$y = 8.6205x + 1.4308$; $R^2 = 0.6642$	$y = 14.598x + 1.81$; $R^2 = 0.7834$
Prepared meal	$y = 0.6048x + 0.1363$; $R^2 = 0.1098$	$y = 4.2606x - 0.4723$; $R^2 = 0.1813$
Seasoning	$y = 2.3005x - 3.1701$; $R^2 = 0.7215$	$y = 9.2262x - 12.5$; $R^2 = 0.8028$
Snacks (starch- and meat-based)	$y = 0.1217x - 0.139$; $R^2 = 0.5714$	$y = 3.2381x - 0.7778$; $R^2 = 0.3811$
Snacks (nut- and bean-based)	$y = 0.4467x + 1.488$; $R^2 = 0.1054$	$y = 1.5522x + 9.6658$; $R^2 = 0.0593$
Soups	$y = 1.0909x + 0.3232$; $R^2 = 0.0765$	$y = 1.9388x - 0.2381$; $R^2 = 0.115$
Soft drink	$y = 7.122x - 4.2145$; $R^2 = 0.8276$	$y = 8.7015x + 11.722$; $R^2 = 0.3644$
Vegetables and fruit juice	$y = 6.567x - 4.387$; $R^2 = 0.8947$	$y = 13.244x - 4.8496$; $R^2 = 0.8704$

* Total product is total newly launched product, include either product with or without displaying Healthier Choice nutritional labeling;

** Total eligible product is total newly launched product that passed the Thailand Healthier Choice scheme's criteria, and either with or without displaying the Healthier Choice nutritional labeling.

Supplementary S6: Mean \pm standard error Health Star rating value of eligible and il-eligible products for bearing Thailand Healthier Choice nutrition labelling, by food category

Food category	Health Star Rating value (Mean \pm SE)					
	N	Eligible products	N	Ineligible products	Differences	p-value
Bakery products	11	3.14 \pm 0.38	589	1.22 \pm 0.03	+ 1.91 \pm 0.19	<0.001
Bread	11	4.09 \pm 0.15	113	2.81 \pm 0.08	+ 1.29 \pm 0.27	<0.001
Breakfast cereal	31	4.32 \pm 0.11	110	3.07 \pm 0.07	+ 1.25 \pm 0.15	<0.001
Dairy products	237	4.13 \pm 0.04	295	3.40 \pm 0.05	+ 0.73 \pm 0.07	<0.001
Fats and oils	7	2.64 \pm 0.21	41	1.32 \pm 0.09	+ 1.33 \pm 0.23	<0.001
Ice-cream	74	2.99 \pm 0.04	243	2.17 \pm 0.04	+ 0.82 \pm 0.07	<0.001
Instant food	171	1.76 \pm 0.07	95	0.76 \pm 0.06	+ 0.99 \pm 0.11	<0.001
Instant tea and coffee	378	2.46 \pm 0.04	181	0.99 \pm 0.05	+ 1.47 \pm 0.07	<0.001
Malted, and chocolate drink	102	2.17 \pm 0.13	47	0.95 \pm 0.16	+ 1.22 \pm 0.22	<0.001
Plant-based milk substitute	195	1.77 \pm 0.11	137	1.82 \pm 0.14	- 0.05 \pm 0.17	0.755
Prepared meal	73	3.64 \pm 0.03	461	3.29 \pm 0.02	+ 0.35 \pm 0.48	<0.001
Seasoning	64	1.41 \pm 0.13	258	1.04 \pm 0.04	+ 0.37 \pm 0.11	0.001
Small Meal	7	3.29 \pm 0.24	53	2.08 \pm 0.12	+ 1.20 \pm 0.35	0.001
Snacks (starch- and meat-based)	60	3.56 \pm 0.10	2076	1.91 \pm 0.02	+ 1.64 \pm 0.12	<0.001
Snacks (nut- and bean-based)	70	4.22 \pm 0.08	289	3.52 \pm 0.05	+ 0.71 \pm 0.11	<0.001
Soups	49	3.50 \pm 0.01	35	3.27 \pm 0.05	+ 0.23 \pm 0.05	<0.001
Soft drink	260	2.63 \pm 0.06	252	0.82 \pm 0.03	+ 1.81 \pm 0.07	<0.001
Vegetables and fruit juice	297	2.28 \pm 0.05	395	1.39 \pm 0.05	+ 0.89 \pm 0.07	<0.001
Total	2,097	2.69 \pm 0.03	5,670	1.99 \pm 0.02	+ 0.71 \pm 0.03	<0.001

Values were expressed as mean \pm standard error. The difference between HSR value of eligible and ineligible products was compared by Independent-t-test