Food Science Research Project

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ND 608

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I. Abstract

This study examined whether the color of a homemade oral rehydration solution (ORS) influenced taste preference among 12-and-under (12U) youth hockey athletes who regularly consume commercial sports drinks. Before tasting, both the homemade ORS samples and the commercial sports drinks typically consumed by the athletes were compared using a standardized printed color scale to document color matches. Athletes then tasted three differently colored ORS samples and rated each one using a seven-point facial hedonic scale. Their usual sports drink color preference was recorded to determine whether they favored an ORS sample that matched the color they typically chose. Although some athletes selected the ORS color that aligned with their usual preference, many did not show a clear match, and several rated multiple samples equally. Overall, the results did not show a strong or consistent pattern indicating that color preference alone determined liking of the homemade ORS.

II. Introduction

Young athletes often develop consistent preferences for the sports drinks they regularly consume, and these preferences are commonly tied to both flavor and color. Because commercial sports drinks use well-recognized color–flavor combinations, the color of a beverage may shape what athletes expect it to taste like. Previous research has shown that when color leads to an incorrect expectation about flavor, people may rate the taste less favorably. This suggests that color could influence how a beverage is evaluated, even when the formulation itself does not change.[1]

This idea is relevant when comparing commercial sports drinks with a homemade oral rehydration solution (ORS), which may not match the flavor–color pairings athletes are accustomed to. If an athlete associates a particular color with a familiar flavor, the color of an unfamiliar drink may influence how much they think they like it, regardless of its actual taste. For this reason, the present

study examined whether the color of a homemade ORS would affect how 12U hockey athletes rated its taste.

Experimental question:

In 12U youth hockey athletes who are accustomed to drinking Gatorade, how does the color of homemade oral rehydration solution affect taste, flavor and preference?

Hypothesis:

Study participants will favorably rate oral rehydration solution based on color preference rather than taste.

III. Materials and Methods

Participants

This study was conducted with a 12-and-under (12U) female travel ice hockey team at their home ice rink. Ten athletes participated in the taste testing. Four additional athletes were not included in the tasting portion: three were restricted from consuming artificial food dyes per caregiver instruction, and one athlete was absent on the day of data collection. Prior to tasting, athletes were asked which color of commercially available sports drink (e.g., Gatorade) they typically preferred. These responses indicated that blue was the most preferred color (n = 6), followed by red (n = 2), with one athlete reporting a preference for yellow and another reporting a preference for orange. Based on these preferences, the three ORS samples used in the test were colored blue, red, and yellow to reflect the most commonly consumed sports drink colors among the team.

Preparation of the Oral Rehydration Solution

An oral rehydration solution (ORS) was prepared based on Dr. D's ORS recipe, which is originally formulated to yield 1 liter of solution. For this study, the recipe was scaled to produce 1.5 liters, providing sufficient volume for each of the 10 athletes to taste 1.5 ounces of each of the three-

color samples (blue, red, and yellow). To prepare the scaled solution, ¾ teaspoon of table salt (source of sodium and chloride), ¾ teaspoon of Nu-Salt potassium chloride salt substitute (source of potassium and chloride), 3 tablespoons plus 1⅛ teaspoons of granulated sugar (source of carbohydrate), and ¾ cup lemon juice (to balance sweetness and acidity) were measured and added to a sanitized pitcher. One and one-half liters of potable water were then added, and the solution was stirred with a long-handled utensil until all solutes were completely dissolved, and the mixture appeared uniform.

The ORS base solution was then divided evenly into three airtight glass pitchers, each containing approximately 500 mL. Food coloring (Badia brand) was added to each pitcher to create the three test samples, with 10 drops of each color (red, yellow, and blue) added per 500 mL pitcher. Unlike all other ingredients, the food coloring quantity was not scaled proportionally from the original recipe. While Dr. D's formulation used 3 drops per 345 mL, we selected 10 drops per pitcher to ensure stronger and more consistent color intensity. Each pitcher was stirred to ensure even color distribution. The ORS samples were covered, refrigerated (approximately 36-46°F), and then transported to the testing site in an insulated cooler with ice packs to maintain temperature. Samples were served chilled and not over ice to avoid dilution of electrolyte and carbohydrate concentration. Any remaining solution was discarded after 48 hours.

Color Assessment

To compare the colors of the three ORS samples (blue, red, and yellow) in a consistent way, each sample was matched against a printed color scale.[2] The color scale was printed on matte paper to avoid glare and viewed under the same indoor lighting for all evaluations. A small amount of each ORS sample was poured into a clear glass, then held next to the color scale to identify which shade it most closely matched. The shade number or name from the scale was recorded for each sample.

Using the printed color scale helped ensure that color differences were assessed in a consistent and objective manner.

Taste Testing Procedure

The tasting session took place at the team's home ice rink, in a clean, designated viewing or lobby area away from active skating areas. To minimize environmental distractions, athletes were called to participate individually. For each athlete, five small 1.5-ounce (approximately 45 mL) transparent plastic tasting cups were prepared and arranged in a straight line on a clean table surface. Three of these cups contained the ORS samples (red, yellow, and blue), while the remaining two cups contained plain water, which was used as a palate rinse between samples. The transparency of the cups was intentional, allowing the visual impact of color to remain fully visible during tasting. Each athlete approached the tasting station individually and was asked to taste the samples in a predetermined sequence. The athlete first consumed the red sample and then completed a seven-point facial hedonic rating scale[3], which ranged from strong dislike to strong liking and used child-friendly facial illustrations. After rating, the athlete drank a small cup of water to clear residual flavor. The same procedure was repeated for the yellow sample and then for the blue sample, with hedonic rating and a water rinse completed after each tasting. Athletes were not informed that the purpose of the study was to evaluate the influence of color; instead, they were told that they were helping to evaluate a homemade sports drink formula. After completing all three ratings, each athlete was thanked and returned to team activities without interacting with athletes who had not yet completed the tasting, in order to prevent influence on subsequent participants. This process was repeated until all ten athletes completed the tasting session.

Data Handling and Interpretation

Rating sheets were collected at the end of each tasting session, and all scores were entered into an Excel spreadsheet for analysis.

IV. Results

Color Assessment

The three ORS samples produced distinct and easily distinguishable colors when compared against the printed Microsoft color scale. The red sample most closely matched ORANGE RED (#FFFF4500), the blue sample corresponded to DODGER BLUE (#FF1E90FF), and the yellow sample aligned with YELLOW (#FFFFFF00). The commercial red sport drink matched the RED shade on the scale (#FFFF0000), while the commercial blue and yellow drinks corresponded to DODGER BLUE and YELLOW, the same shades produced in our homemade ORS samples. All samples demonstrated strong color saturation without visible cloudiness or precipitation, indicating thorough mixing of the food coloring into the base solution. Matching the samples to the printed scale allowed for consistent documentation of color appearance prior to taste testing and confirmed that the three beverages differed in color in a clear and objective manner. It also provided a direct comparison between the homemade ORS colors and the commercial sport drink color that the participants were familiar with.

Hedonic Rating Analysis

Ten athletes completed hedonic ratings for each ORS color sample. The mean liking scores showed modest differences across the three colors: the yellow sample received an average rating of 3.4 (SD = 1.58), the red sample averaged 4.0 (SD = 2.05), and the blue sample received the highest average rating of 4.7 (SD = 1.89). Although blue had the strongest average score, all three drinks showed fairly large standard deviations, meaning that athletes differed widely in how they rated each sample. To compare these tasting results with the athletes' usual color preferences, each

participant's preferred Gatorade color was matched with the ORS color they rated highest. Five athletes showed a clear match between their preferred color and their highest rating: participants 2, 6, and 9, who preferred blue, rated the blue ORS highest, and participants 8 and 10, who preferred red, rated the red ORS highest. Four athletes (participants 3, 4, 5, and 7) did not show a clear preference because they rated two or all three samples equally. The only athlete who clearly did not match their stated preference was Participant 1, who initially gave preference to the orange commercial sport drink; because no orange ORS was available, we would have expected their choice to lean toward a more similar color (red or yellow based on the color scale), yet they gave their highest rating to the blue sample instead. Overall, when ties are excluded, only five out of ten participants showed a tasting preference that matched the color they normally choose. The completed hedonic rating sheets and the Excel spreadsheet used for this analysis are included in the Appendix.

V. Discussion

Previous research has shown that beverage color can influence perceived flavor intensity and preference in children,[4] with individuals often rating drinks more favorably when the color matches their expectations for a given flavor profile.[5]

The purpose of this study was to determine whether 12U hockey athletes would rate a homemade oral rehydration solution more favorably when its color matched the color of the sports drink they typically preferred. Although five out of the ten participants rated the ORS color that aligned with their usual drink preference the highest, this number was not large enough to show a clear or consistent pattern across the group. Several participants rated two or more samples equally, which made it difficult to identify a distinct preference for those individuals. One athlete who initially preferred an orange commercial sports drink provides a useful example: because orange was not

included among the ORS samples, we expected this participant to select a color most closely related to orange on the color scale (either red or yellow). Instead, they rated the blue sample highest, suggesting that their choice was not guided by color similarity or expectation. Taken together, these findings indicate that color preference alone did not consistently shape how the athletes rated the ORS samples in this setting.

Limitations

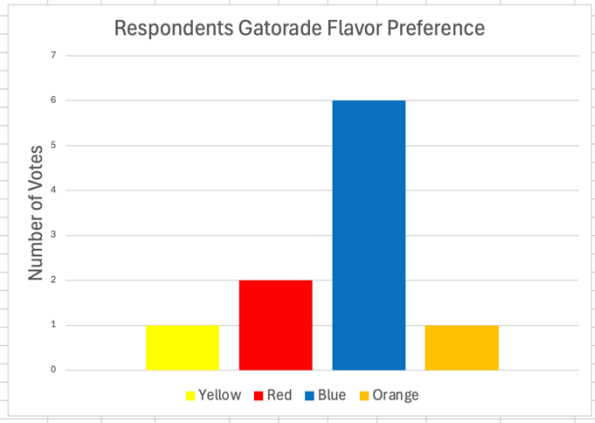
Several limitations of this study should be considered when interpreting the findings. First, the sample size was small, with only ten athletes participating, which limits the strength and generalizability of the results. Second, children are known to be biased toward new foods and beverages, and the fact that our samples were not presented in the same packaging or format as the commercial sports drinks they typically consume may have influenced their ratings independently of taste or color.[6] Third, the color of each ORS sample may have created visual expectations about how the drink should taste based on the flavors children normally associate with those colors in commercial sports drinks. Because our ORS had a noticeably lemon-forward flavor that did not necessarily match the flavor profiles they expected from red, yellow, or blue sports drinks, these mismatched expectations may have altered the athletes' liking scores.[7, 8] Further studies should be conducted with a larger sample size and with flavor profiles and packaging more closely aligned to commercial products to better isolate the effect of color on taste preference.

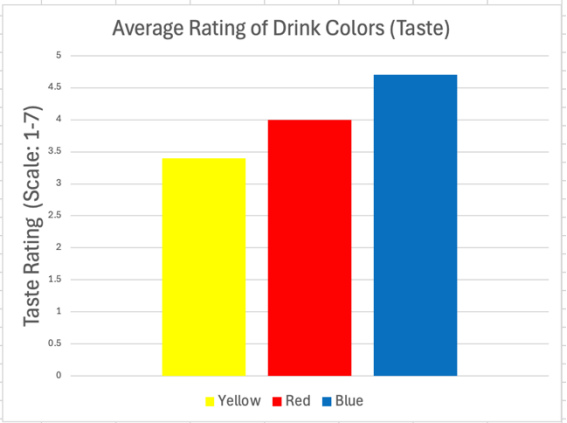
VI. Appendix

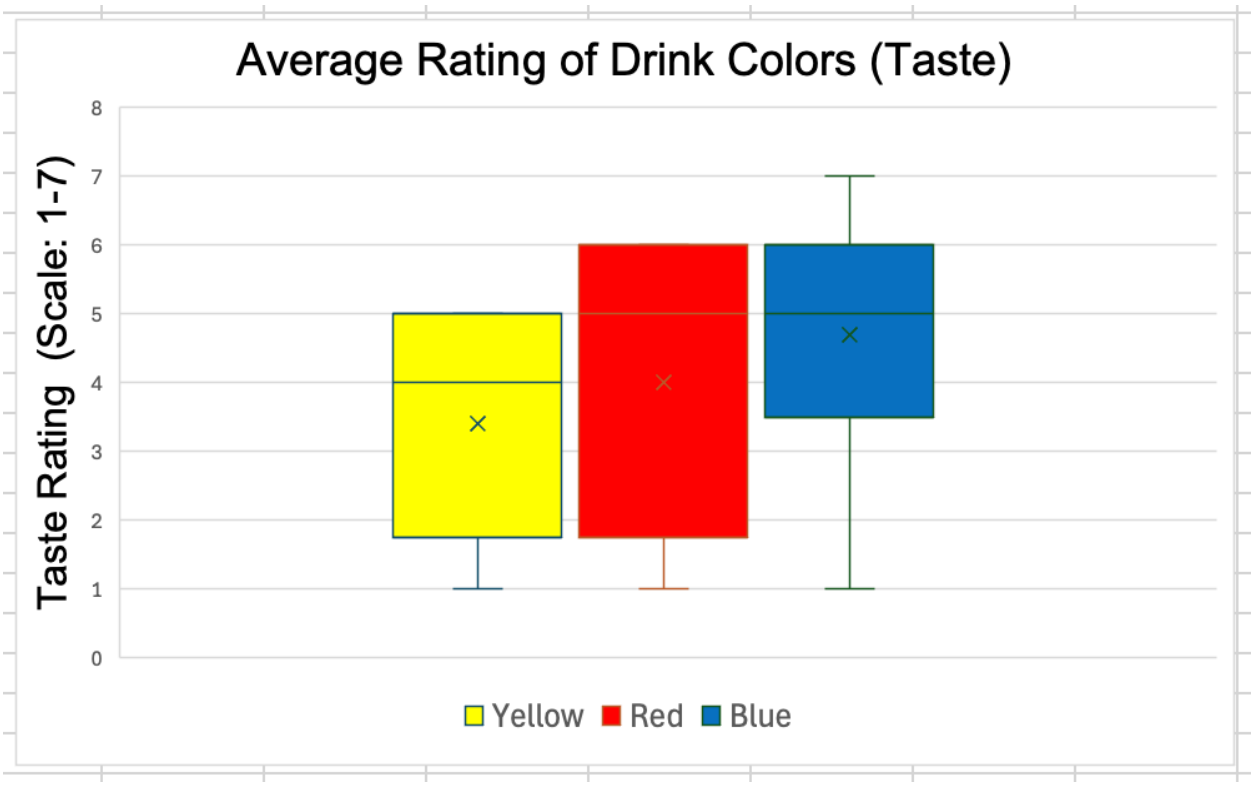
(a) Data Analysis Spreadsheet

	Taste test rating		
	Yellow	Red	Blue
1	5	3	6
2	2	1	5
3	1	1	1
4	4	6	6
5	1	2	2
6	4	6	7
7	5	5	5
8	4	6	5
9	5	5	6
10	3	5	4
Ave:	3.4	4	4.7

	Favorite Gatorade Flavor			
	Yellow	Red	Blue	Orange
				x
			x	
			x	
			x	
	x			
			x	
			x	
		x		
			x	
		x		
Sum:	1	2	6	1





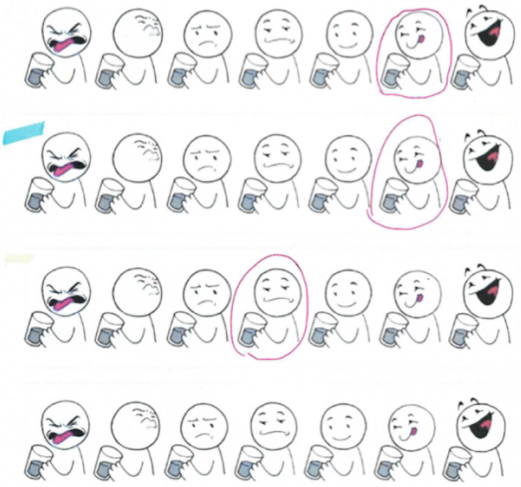


(b) Completed Hedonic Scales

P#3

Blue

P#4



Blue

P#5

yellow

P#6

Blue

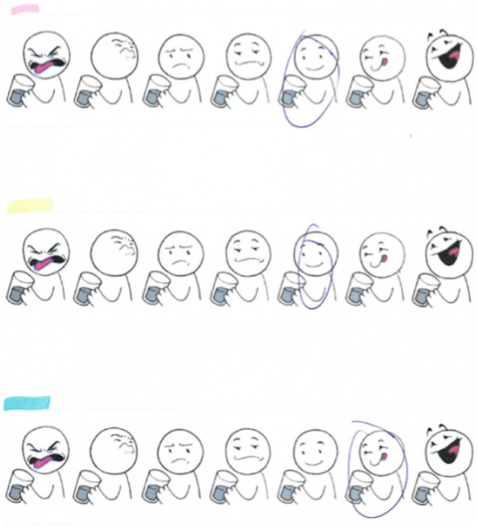
P#7

Light Blue

P#8

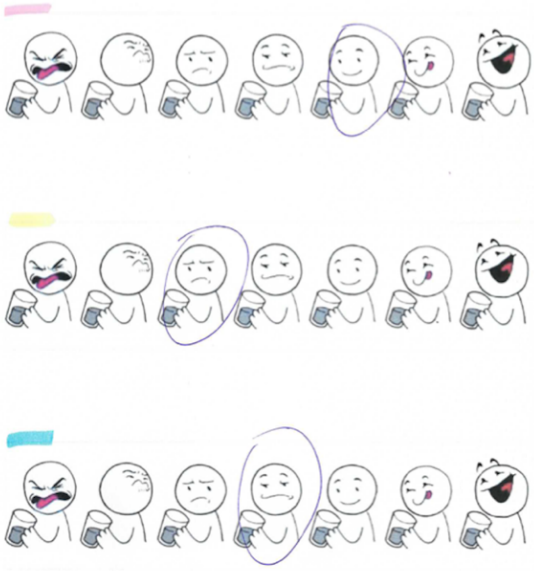
Red

P#9



Blue

P#10



Red

(c) Photographs


GATORADE
FIERCE
THIRST QUENCHER
FRUIT PUNCH + BERRY


LEMON LIME

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