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The impact of front-of-package claims, fruit images, and health warnings on consumers' perceptions of sugar-sweetened fruit drinks: Three randomized experiments

Marissa G. Hall^{1,2}, Allison J. Lazard^{3,2}, Anna H. Grummon^{1,4}, Jennifer R. Mendel², Lindsey Smith Taillie^{4,5}

¹Department of Health Behavior, Gillings School of Global Public Health, University of North Carolina

²Lineberger Comprehensive Cancer Center, University of North Carolina

³School of Media and Journalism, University of North Carolina

⁴Carolina Population Center, University of North Carolina

⁵Department of Nutrition, Gillings School of Global Public Health, University of North Carolina

Abstract

We aimed to examine the impact of claims, fruit images, and health warnings on consumers' perceptions of fruit-flavored drinks with added sugar (i.e., "fruit drinks"). We conducted three 2×2×2 randomized experiments with online convenience samples of U.S. adults (Study 1 $n=2,139$ in 2018, current e-cigarette users and smokers; Study 2 $n=670$ in 2018, current e-cigarette users; Study 3 $n=1,001$ in 2019, general sample). Participants viewed a fruit drink that differed in the presence of a "100% Vitamin C" nutrition claim, a fruit image, or a health warning. On average across the three studies, consumers who saw a claim on a fruit drink believed that the drink was more healthful than those who did not see the claim (mean average differential effect (ADE)=.66, $p<.001$); they were also more interested in consuming the drink (mean ADE=.38, $p=.001$). The health warning decreased perceived product healthfulness (mean ADE=-.65, $p<.001$) and consumption interest (mean ADE=-.49, $p<.001$). The fruit image had no effect on perceived product healthfulness (mean ADE=.03, $p=.81$) or purchase intentions (mean ADE=-.04, $p=.77$). In Study 1 and Study 2, there were no interactions between claims, images, or warnings (all $p>.05$). In Study 3, the "100% Vitamin C" nutrition claim only increased perceived product healthfulness when the drink did not also have a health warning (interaction $p<.05$). These findings suggest that

To whom correspondence should be addressed: Marissa G. Hall, PhD, Department of Health Behavior, Gillings School of Global Public Health, University of North Carolina Chapel Hill, 312 Rosenau Hall, CB #7440, Chapel Hill NC 27599, mghall@unc.edu. Credit Author Statement

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100% Vitamin C claims increase the appeal of fruit drinks, whereas health warnings decrease the appeal. Together, these studies support policies to restrict marketing and require health warnings on sugar-sweetened beverage packaging.

Keywords

Fruit drinks; sugar-sweetened beverages; health warnings; warning labels; front of package labels; claims; nutrition claims; marketing; product packaging

INTRODUCTION

Sugar-sweetened beverage (SSB) consumption is a major driver of the obesity epidemic among both children and adults (1, 2). Fruit-flavored drinks with added sugar (hereinafter referred to as “fruit drinks”) are the most popular SSB besides soda among adults and are by far the most consumed SSB among children (3). Thus, strategies to reduce fruit drink intake could reduce overall SSB consumption, and subsequently could help to prevent obesity and its associated health consequences.

One promising policy strategy for reducing SSB intake is restricting marketing cues, including nutrient content claims and images, on SSB packaging. Nutrient content claims (i.e., text statements characterizing the level of a nutrient such as “low fat”) are a highly prevalent marketing claim used on beverage packages, and are regulated by the U.S. Food and Drug Administration (FDA) (4). A 2014 report found that fruit drink packages in the U.S. contain an average of 4.3 different claims (5). Nutrient content claims may lead consumers to mistakenly infer that a product is healthful, regardless of its overall nutritional profile (i.e., the “health halo effect”), and can subsequently increase intentions to purchase the product (6–10). More research is needed to elucidate the impact of claims on interest in fruit drinks in particular, given that consumers already incorrectly believe that fruit drinks are healthier than other types of SSBs like soda (11, 12).

In addition to nutrient content claims, images of fruits are another common marketing element on food and fruit drink packaging (13, 14), even when these products do not contain fruit or are not 100% fruit juice. A large body of research has shown how cartoon characters on product packaging increase consumer preferences and intake (15, 16), but less is known about other features such as fruit images.

A second promising strategy for reducing SSB intake is requiring health warnings on the front of SSB packages. Lawmakers in five U.S. states have proposed laws requiring health warnings to appear on SSBs, and FDA has demonstrated an interest in stronger nutrition labels by commissioning two reviews of front-of-package labels (17, 18). Several online studies have found that SSB health warnings affect key antecedents to behavior change, such as visual attention (19, 20) and intentions to purchase SSBs (11, 21–24). One recent randomized trial found that health warnings placed on SSB containers reduced actual SSB purchases (25). However, it remains unknown whether SSB health warnings interact with marketing elements. Tobacco research suggests that removing marketing elements, including claims and imagery, from cigarette packages may heighten the impact of health warnings

(26–28), suggesting that the effectiveness of health warnings could be reduced by marketing elements. It is also possible that health warnings could weaken the effect of marketing elements or that the effects of warnings and marketing elements might “cancel out” one another. These questions merit further exploration in the context of SSB packing.

The current studies aimed to fill key gaps in the literature by studying two marketing cues (i.e., nutrient content claims and fruit images) used on fruit drinks and their possible interaction with health warnings. Specifically, in three experiment replications, we examined the impact of front-of-package nutrient content claims, fruit images, and health warnings on perceived product healthfulness and interest in consuming fruit drinks, two constructs theorized to predict behavior change (29, 30). Based on prior research (6–11, 21, 23–25, 31–33), we predicted that nutrient content claims and fruit images would lead to greater perceived product healthfulness and consumption interest whereas health warnings would lead to lower perceived product healthfulness and consumption interest. We also predicted that the effect of nutrient content claims and fruit images would weaken the health warnings.

METHODS

Participants

For Study 1, in August 2018, we recruited a convenience sample of U.S. adults, ages 18 or older to participate in an online experiment. Online convenience samples can yield highly generalizable findings for experiments (34). Participants were recruited for an e-cigarette study to examine vaping prevention (35). Thus, participants were eligible if they were current e-cigarette users (defined as currently vaping every day or some days), current smokers (defined as having smoked at least 100 cigarettes and now smoking every day or some days), or dual users (defined as both current smokers and current e-cigarette users). Recruitment occurred through Amazon’s Prime Panels, a platform with access to over 20 million participants for behavioral research. For Study 2, we recruited a convenience sample of U.S. adults in December 2018 through Amazon’s Prime Panels to participate in an online experiment. The main purpose of this e-cigarette study was to develop a new measure about e-cigarette use, so participants were eligible if they were current e-cigarette users (as defined in Study 1). For Study 3, we recruited a convenience sample of U.S. adults (including 65% non-tobacco users) using Amazon Mechanical Turk in December 2019. The main purpose of this study was to replicate the current experiment with a general sample, so the study was open to all adults ages 18 and older residing in the U.S.

Procedures

The procedures were identical for all three studies. We conducted a between-subjects 2×2×2 experiment, representing eight different conditions (Figure 1). The three experimental factors were nutrient content claim (no claim vs. “100% Vitamin C,” a prevalent claim on SSBs, particularly fruit drinks (5)), image of fruit (no image vs. image of oranges), and health warning (no warning vs. “WARNING: Beverages with added sugar contribute to tooth decay, diabetes, and obesity.”). We selected this warning because previous studies have shown that it increases perceived message effectiveness (24) and reduces SSB purchases (25) compared to control labels. The experimental factors were displayed on an image of an

orange fruit drink, created by a professional designer. To control for established brand preferences, the image displayed the logo of a Japanese food company (i.e., “Nissin”) that has the realism of an actual brand but would be unfamiliar to most U.S. consumers (36).

After providing informed consent, participants in the three studies completed an online survey primarily about e-cigarettes. Participants viewed a prompt that read: “On the next page, you’ll see a sweetened fruit drink (not 100% juice). Then you’ll answer some questions.” Participants were then randomly assigned to view one of the eight experimental conditions and answered survey items. Participants in Study 1 and Study 2 received incentives in cash, gift cards, or reward points from Amazon’s Prime Panels. Participants in Study 3 received an incentive of \$1.40. The University of North Carolina institutional review board approved these studies. Prior to data collection, we pre-registered Study 1 on AsPredicted.org: <http://aspredicted.org/blind.php?x=543ti3>. Studies 2 and 3 were replications of Study 1, with identical predictions and procedures, so we did not pre-register those studies.

Measures

The measures were identical across the three studies. We assessed perceived product healthfulness with an item adapted from a previous study (22) that read: “How healthy or unhealthy would it be for you to drink this product every day?” Response options were on a seven-point scale ranging from “unhealthy” (coded as 1) to “healthy” (coded as 7). We measured consumption interest using an item adapted from a prior study (11) that read: “How interested would you be in drinking this product in the next 30 days, if it were available?” Response options were on a seven-point scale ranging from “not at all interested” (coded as 1) to “extremely interested” (coded as 7). Participants then answered standard demographic items such as age, race, and ethnicity. We assessed frequency of fruit drink consumption with an item adapted from a standardized beverage intake questionnaire (37) that read: “How often did you drink sweetened fruit drinks (not 100% juice) like lemonade, fruit punch, Capri Sun, or Oceanspray juice cocktail in the past 30 days?”

Data analysis

Analyses used Stata/SE version 14.1 with two-tailed tests and a critical alpha of 0.05. The analytic samples included participants with complete data on both outcomes ($n=2,139$ for Study 1, $n=670$ for Study 2, $n=1,006$ for Study 3). The analytic procedures were identical for the three studies. We first examined whether randomization created equivalent groups using chi-squared tests for categorical variables and t -tests for continuous variables. In all three studies, sexual orientation was not equally distributed across the eight conditions ($p=0.03$ for Study 1, $p=0.003$ for Study 2, $p=0.02$ for Study 3) and low-income status was not equally distributed in Study 3 ($p=0.02$). Unadjusted analyses revealed an identical pattern of findings compared to the adjusted findings, so we report only the unadjusted findings per the CONSORT guidelines for randomized trials (38).

We ran two linear regression models for each study, one with perceived product healthfulness as the outcome and one with consumption interest as the outcome. The initial models included indicators for the three experimental factors and all interactions between

these three factors. The final models for all studies retained only the significant interactions. Due to skewness of the residuals of the outcomes (most Shapiro-Wilk tests (39) of residuals indicated significant skewness), we conducted sensitivity analysis with ordinal regression models; the pattern of findings was identical so we report linear models for ease of interpretation. We report average differential effects of each experimental factor on the outcomes as generated by the final models. We probed interactions by calculating means at different levels of the moderating factors. To synthesize the findings across the three studies, we estimated average effects by taking the unweighted mean of the point estimates for each study. We then obtained a standard error and t-statistic for each of these average effects. Finally, to put the effects into a common metric, we calculated a standardized effect size (Cohen's *d*) with 95% confidence intervals.

RESULTS

Most (81%) Study 1 participants were White, 61% had not completed college, nearly half (47%) were low income, and over half (56%) consumed fruit drinks at least once a week (Table 1). Similarly, 76% of Study 2 participants were White, 61% had not completed college, 48% were low income, and 63% consumed fruit drinks at least once a week. Study 3 participants were 77% White, 31% had not completed college, 35% were low income, and about half (46%) consumed fruit drinks at least once a week.

Participants exposed to the “100% Vitamin C” claim rated the fruit drink as more healthful than those who did not see the claim in all three studies (mean average differential effect (ADE)=.66, all $p<.001$). On average across the three studies, the “100% Vitamin C” claim led to higher consumption intentions (mean ADE=.38, $p=.001$), despite differences among studies. In Study 1 and Study 2, participants who viewed the “100% Vitamin C” claim were more interested in consuming the fruit drink (Study 1 ADE=.49, $p<.001$; Study 2 ADE=.43, $p=.006$), but the effect was not significant at the 0.05 level in Study 3 (ADE=.21, $p=.09$).

On average across the three studies, the fruit image did not change perceived product healthfulness (mean ADE=.03, $p=.81$) or purchase intentions (mean ADE=-.04, $p=.77$). In Studies 1 and 2, the fruit image had no effect on perceived product healthfulness (Study 1 ADE=-.03, $p=.67$; Study 2 ADE=-.15, $p=.29$) or purchase intentions (Study 1 ADE=-.10, $p=.27$; Study 2 ADE=-.22, $p=.16$). In Study 3, however, the fruit image led to greater perceived product healthfulness (Study 3 ADE=.26, $p=.014$) but not consumption interest (ADE=.21, $p=.09$).

In all three studies, health warnings led to lower perceived healthfulness of the fruit drink (mean ADE=-.65, all $p<.001$). Health warnings also led to lower interest in consuming the fruit drink in all three studies (mean ADE=-.49, all $p<.05$).

In Study 1 and Study 2, there were no interactions between claims, images, or warnings (all $p>.05$). In Study 3, there was an interaction between the “100% Vitamin C” claim and the health warning on perceived product healthfulness of fruit drink (interaction $p=.009$), such that “100% Vitamin C” only increased perceived product healthfulness without a health

warning (ADE of claim without warning=.79, $p<.001$; ADE of claim with warning=.21, $p=.10$).

DISCUSSION

In three experiments with U.S. adults (two studies with current tobacco users and one with a majority of non-users of tobacco), participants who saw a “100% Vitamin C” claim on a fruit drink believed that the fruit drink was more healthful than those who did not see the claim. Participants who saw the claim were also more interested in consuming the fruit drink. These findings build on prior research that has found that health-related and nutrient content claims make food and beverages seem healthier and more appealing (6–10, 32). The observed findings are particularly concerning given high rates of consumption of fruit drinks in the U.S., particularly Black and Latino youth (40, 41). In light of these findings and prior research, FDA should be concerned that nutrient content claims can cause consumers to mistakenly think SSBs are healthy. If future research continues to show similar types of misconceptions among consumers, policymakers should consider taking regulatory action to prevent claims from causing consumer deception. One option for regulation could include requiring a disclosure statement on fruit drinks. However, many studies have shown that disclosures are generally ineffective and do not correct misperceptions (42–44). A likely more effective regulatory action would be banning the use of specific misleading claims (similar to a 2010 ban of the use of misleading terms such “light” on cigarette packaging).

In all three experiments, participants who saw a health warning on a fruit drink believed that the fruit drink was less healthful than those who did not see the warning. Likewise, participants in all three studies who saw the health warning were less interested in consuming the fruit drink. These findings build on a growing body of research demonstrating the promise of front-of-package warnings on SSBs (11, 21, 23–25), and provide additional data to policymakers in the U.S. and globally considering SSB warning policies. Based on prior tobacco studies (26–28), we expected that the effect of health warnings would be weakened by claims and fruit images. We generally did not observe these hypothesized interactions. However, in Study 3, we found that the impact of the claim on perceived product healthfulness disappeared in the presence of a health warning. In other words, in this study, health warnings did appear to weaken the effect of the claim on perceptions of the fruit drink’s healthfulness. Additional research will clarify the extent to which health warnings, including pictorial warnings which are more effective than text warnings (45–47), might reduce the effects of claims.

The presence of a fruit image on a fruit drink did not change perceptions of product healthfulness or consumption interest. The one exception to this overall pattern of null findings was that the fruit image increased perceived product healthfulness among a combined sample of smokers and non-smokers in Study 3. This overall pattern of null findings stands in contrast with qualitative studies that found that fruit images on product packaging can lead parents (48) and children (49) to believe that products are more healthful. Our findings build on one prior study that concluded that including a fruit image on granola bar packaging did not change perceived product healthfulness (50). One possible explanation for our null findings could be that selected image of oranges did not attract

attention given that it matched the background color of the product. Previous research has also found that color alone influences perceptions of sweetness, taste, and quality (51–53), so the orange fruit image and the orange-colored background may have been conveying redundant information to consumers. Future studies should consider testing images of multiple types of fruit as well as images with varied levels of realism (e.g., cartoonlike images of fruit).

Strengths of this study include the exact replication of stimuli and measures in three samples and the use of randomized factorial experiments. We largely observed the same pattern of findings across the three studies, but observed some differences noted above. The differences across studies could be due either to random chance or due to differences in the samples. One limitation is that two of the studies (but not the third) involved convenience samples of solely tobacco product users, meaning the generalizability of the findings to other populations remains to be established. However, online convenience samples tend to provide valid results for experiments, accurately estimating the impact of manipulated variables (54–56). Future studies with representative samples could extend the generalizability of these findings and could also help to better understand individual factors that influence perceptions of fruit drinks. Moreover, the sample includes only adults so the effects on children remains unknown. We only tested one type of drink with a mock brand; examining drinks that are not known to have high Vitamin C content, or real brands, may have yielded different results. Finally, the studies used a brief exposure to the study stimuli on a computer screen and assessed non-behavioral outcomes using self-report.

Conclusions

Our studies found that a “100% Vitamin C” claim increased consumers’ beliefs that sugar-sweetened fruit drinks are healthful, providing evidence to policymakers considering restricting marketing elements on SSB packaging. We also found that the presence of a health warning lowered consumers’ beliefs that sugar-sweetened fruit drinks are healthful and reduced their interest in the drinks, supporting health warnings as a policy for reducing SSB consumption. Future studies should examine the effects of claims, imagery, and warnings in naturalistic settings using objective outcomes such as purchasing or consumption behavior.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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HIGHLIGHTS

- Sugar-sweetened fruit drinks are unhealthy but commonly consumed by children.
- In our study, nutrition claims made people think fruit drinks were healthy.
- Health warnings helped people understand that fruit drinks were unhealthy.



Figure 1.
Stimuli used in Studies 1, 2, and 3

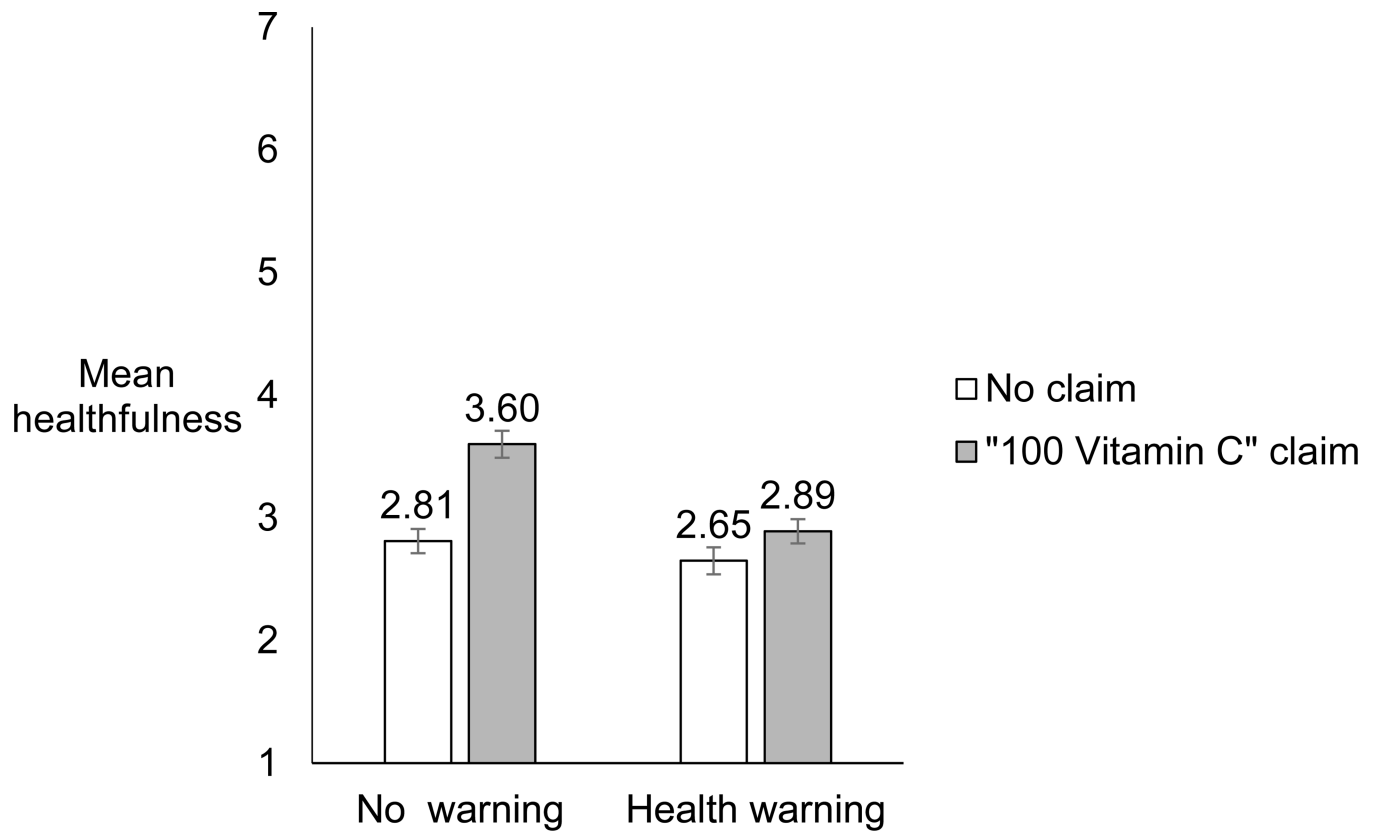


Figure 2. Interaction between “100% Vitamin C” claim and health warning on perceived product healthfulness of fruit drink, Study 3 ($n=1,006$)

Table 1.

Participant characteristics

	Study 1 (n=2,139)		Study 2 (n=670)		Study 3 (n=1,006)	
	n	%	n	%	n	%
Age in years						
Mean (SD)	43	(15)	37	(13)	39	(12)
Range	[18–85]		[18–82]		[20–76]	
Gender						
Female	1,187	55.5	343	51.2	458	45.9
Male	952	44.5	327	48.8	537	53.8
Gay, lesbian, or bisexual	207	9.7	80	11.9	120	12.1
Hispanic	211	9.9	65	9.9	138	13.7
Race						
American Indian or Alaskan Native	41	2.0	6	0.9	7	0.7
Asian	79	3.8	33	5.1	62	6.3
Black or African American	216	10.3	80	12.3	137	13.8
Native Hawaiian or Pacific Islander	10	0.5	1	0.2	4	0.4
White	1,703	80.8	492	75.5	760	76.6
Other	58	2.8	40	6.1	22	2.2
Education						
High school graduate or less	650	30.4	189	28.2	113	11.3
Some college	662	31.0	222	33.1	192	19.2
College graduate or associates degree	682	32.0	218	32.5	549	55.0
Graduate degree	142	6.6	41	6.1	145	14.5
Household income, annual						
\$0–\$24,999	562	26.3	173	25.8	158	15.7
\$25,000–\$49,999	697	32.6	213	31.8	325	32.3
\$50,000–\$74,999	427	20.0	123	18.4	250	24.9
\$75,000+	453	21.2	161	24.0	273	27.1
Low income [†]	1,102	47.4	320	48.1	349	35.0
1+ child ages 0–18 in household	--	--	--	--	427	42.5
Tobacco use						
Current e-cigarette user only	432	20.2	302	45.1	81	8.1
Current smoker only	833	38.9	0	0.0	135	13.5
Dual e-cigarette user and smoker	874	40.9	368	54.9	130	13.0
Not current e-cigarette user or smoker	0	0.0	0	0.0	653	65.4
Frequency of fruit drink consumption						
Never	444	20.8	120	17.9	315	31.3
<1 time per week	504	23.6	131	19.6	226	22.5
1–6 times per week	936	43.8	325	48.5	359	35.7
1+ times per day	255	11.9	94	14.0	106	10.5

Note. Missing demographic data range from 0% to 2.7%. -- = not assessed.

¹ <200% of 2018 federal poverty level

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Table 2.

Effects of “100% Vitamin C” claim, fruit image, and health warning on perceived product healthfulness and consumption interest, in Study 1 ($n=2,149$), Study 2 ($n=670$), Study 3 ($n=1,006$), and overall ($n=3,825$)

	Perceived product healthfulness			Consumption interest		
	ADE	SE	<i>p</i>	ADE	SE	<i>p</i>
“100% Vitamin C” claim						
Study 1	.75	.08	<.001	.49	.09	<.001
Study 2	.72	.14	<.001	.43	.16	.006
Study 3	.51	.10	<.001	.21	.12	.09
Average	.66	.11	<.001	.38	.13	.001
Fruit image						
Study 1	-.03	.08	.67	-.10	.09	.27
Study 2	-.15	.14	.29	-.22	.16	.16
Study 3	.26	.10	.014	.21	.12	.09
Average	.03	.11	.81	-.04	.13	.77
Health warning						
Study 1	-.94	.08	<.001	-.60	.09	<.001
Study 2	-.57	.14	<.001	-.53	.16	.001
Study 3	-.44	.10	<.001	-.35	.12	.005
Average	-.65	.11	<.001	-.49	.13	<.001

Note. ADE=average differential effect from linear regression models. SE=standard error. **Bold** indicates statistically significant findings at $p<.05$ level.