Short Communication

Is evoking fear effective? Exploratory findings from a randomised experiment on the impacts of health warning labels on sugar-sweetened beverages

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Abstract

Objective: Health warning labels (HWL) have been suggested to be effective in reducing consumption of sugar-sweetened beverages (SSB). Yet, the efficacy and acceptability of SSB HWL of different formats (textual/pictorial) and severity remain unclear. This exploratory study aims to examine the extent and mechanism through which HWL of different formats and severity may affect responses towards the HWL and SSB consumption.
Design: Randomised online experiment. Participants were exposed to images of a hypothetical SSB bearing a HWL of one of three conditions: text-only HWL, moderately severe pictorial HWL and highly severe pictorial HWL. They then responded to theory-based affective, cognitive and behavioural measures.
Setting: Singapore
Participants: One hundred and twenty-seven young adult consumers from a public university
Results: Direct effects were found for fear, avoidance, reactance and acceptability of the HWL, but not attitude, intention or motivation to consume less SSB. Pictorial (moderately severe and highly severe) HWL were associated with greater fear, avoidance, and reactance, and lower acceptability than text-only HWL. There was weak evidence that highly severe pictorial HWL resulted in greater reactance than moderately severe pictorial HWL. Fear mediated the effect of HWL of different severity levels on avoidance, reactance, intention and motivation, but not for attitude or acceptability.
Conclusions: Exploratory findings indicate that although pictorial HWL were less acceptable, they may still be effective in influencing intention and motivation to reduce SSB consumption through the psychological mechanism of fear. Hence, graphic HWL should not be dismissed too quickly when considering strategies for reducing SSB consumption.

Overconsumption of sugar-sweetened beverages (SSB) is a key culprit for childhood and adult obesity[1–3]. One possible approach to mitigate this is to mandate the use of front-of-package labels on SSB. Singapore, a country also grappling with obesity and diabetes[4], has recently deliberated on the appropriate measures to reduce sugar intake, including the implementation of nutrition labels and warning labels[5,6]. Health warning labels (HWL) have been demonstrated to be effective in reducing smoking and alcohol consumption[7,8]. Its efficacy has also been suggested for the SSB context[9], but two main gaps remain.

First, the effectiveness and acceptability of HWL can vary depending on the health context, presentation formats[10] and graphicness of disease depictions[8]. However, the impact of particular HWL characteristics on its effectiveness and acceptability in the SSB context remain unclear[9]. HWL

generally rely on fear appeals, which are messages designed to persuade the receiver to take a particular action by stimulating his/her emotion of fear, usually by using vivid, verbal description or gory images to bring out 'gruesome content' that is, at the same time, portrayed as applicable to the receiver[11]. In line with the tenets of fear appeal[12], prior HWL research on cigarette packaging, alcoholic drinks and SSB has indicated pictorial HWL to be more effective than text-only HWL[8,10,13–15]. More graphic pictorial HWL have also been associated with greater motivation to reduce undesirable behaviours than less graphic pictorial HWL in alcohol and cigarette packaging[7,8,15]. However, more efficacious HWL can result in greater avoidance (i.e. avoiding looking at the message) and reactance (i.e. rejection of the message due to perceived threat to one's freedom)[8,14], and, therefore, be deemed less acceptable[16]. This could be problematic as the success of a policy initiative is influenced by its effectiveness and acceptability[17]. There is thus a need to empirically assess the most effective and acceptable HWL design for SSB to support decision-making by public health policymakers, who have to consider both efficacy and public attitudes to policy initiatives. Moreover, while there has been increasing evidence surrounding the effectiveness of SSB HWL, less is known about the acceptability of such policies[18].

Second, the psychological mechanism behind the effect of HWL on behavioural responses in the SSB context is unclear[19]. Examining such pathways is important to inform the design of HWL that can optimally influence the mediating factors to ultimately impact behavioural outcomes[20]. In cigarette packaging studies, fear mediated the relationship between graphic HWL and greater intention to quit smoking[7,13,21]. There has also been evidence of a positive link between avoidance[22–24] and reactance[25] with quitting intentions, although other studies have also found contrary results for reactance[21,24]. Likewise, studies examining the psychological mechanisms in SSB consumption have produced mixed findings. For instance, while negative affect[26,27] and negative emotions[26] have been demonstrated to mediate the effect of HWL on SSB behavioural outcomes, a recent study[28] did not find negative emotions to be a significant mediator. Additionally, to our knowledge, the effect on avoidance has not been examined in prior SSB studies. Addressing these gaps is critical for designing more effective HWL that can capitalise on the effects of these mediators to induce more favourable SSB consumption outcomes, particularly in the less researched Asian context.

This study, therefore, aims to examine the extent and mechanism through which HWL of different formats (pictorial/text-only) and content severity levels may affect SSB consumption. Based on the theoretical framework of the Extended Parallel Process Model (EPPM)[29] and existing literature, we hypothesise that participants exposed to a highly severe pictorial HWL will report the highest level of fear, strongest avoidance and reactance towards the HWL, most positive attitude, intention, and motivation towards

reducing consumption of SSB, but lowest level of acceptability of the HWL, followed by those exposed to a moderately severe pictorial HWL, and those exposed to a text-only HWL. Additionally, we hypothesise that fear will mediate the effects of HWL with varying content severity levels on responses to HWL and SSB consumption.

Methods

Study design and participants

The study was conducted in March 2020 in Singapore. For the main study, 127 university student participants were recruited via electronic direct mailing (72 % female; aged 21–27 years, M = 22·8, SD = 1·41; 94 % Chinese). They were randomly assigned to one of three HWL experimental conditions (text-only (n 39), moderately severe pictorial (n 43), and highly severe pictorial (n 45)) in an online experiment and paid a monetary compensation of SGD$2·00 (equivalent to US $1·46). Participant characteristics are shown in online supplementary material, Supplemental Table 1.

Stimuli

To avoid prejudice from participants, a cola product with a mockup brand was designed to bear a HWL from one of three experimental conditions (Fig. 1): the text-only HWL only bears two sentences (stating the likelihood of getting the disease and the recommended behaviour to prevent it) with a blank space underneath, while the pictorial HWL include the same text with graphic disease images of varying content severity levels (moderately severe v. highly severe) below it. The images were selected based on a pretest (see online supplementary material, Supplemental material).

Data collection

Participants were recruited via mass emails embedded with a link to access the online experiment. Upon consent, participants were shown two successive images of the cola drink can in randomised order, each bearing a HWL with a different disease but of the same severity level (text-only/ moderately severe/highly severe). Participants then answered multi-item measures grounded on the fear appeal theory of EPPM (see online supplementary material, Supplemental Table 2) to assess perceived fear[11], avoidance towards the HWL[8], reactance to the HWL[8], attitude towards cutting down consumption of beverages with added sugar(s)[11] and intention to cut down consumption of beverages with added sugar(s)[30]. The multi-item measures had acceptable to good internal consistencies. Additionally, participants answered single-item measures on the extent to which the HWL motivated them to consume less beverages with added sugars[8] and the acceptability of introducing the HWL on SSB[16]. Demographic information collected includes gender, age, personal and familial history of diabetes, and dieting status.
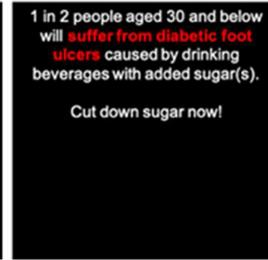
Fig. 1 (a) Example of the two stimuli shown to participants. Each drink can bore health warning labels (HWL) of the same experimental condition but different disease. (b) Examples of HWL used. Disease images were sourced from Park, J.Y., & Jung H.G. (2016). Diabetic Foot: Ulcer, Infection, Ischemic Gangrene. In Hong-Geun Jung. (Eds). Foot and Ankle Disorders. Springer, Berlin, Heidelberg; and New Results Medical Weight Loss. (n.d.). Male Weight Gain New Results Medical Weight Loss. Retrieved March, 2020, from https://newresultsmedicalweightloss.com/male-weight-gain-low-t/.

Question sequence was randomised to minimise any potential order effects.

Data analysis

One-way ANCOVA with least significant difference (LSD) *post hoc* tests were performed to analyse the effects of HWL design on the main outcome variables. To analyse the mediating effect of fear, mediation analyses using the SPSS PROCESS Macro model $4^{(31)}$ were performed. For all analyses, age, gender, dieting status and family diabetes were entered as covariates.

Results

Manipulation check

The ANCOVA results indicated a significant difference in the perceived graphicness of HWL across the three conditions (Table 1). As expected, those exposed to highly severe ($P < 0.001$) and moderately severe ($P < 0.001$) pictorial HWL rated the pictures to be significantly more graphic than those exposed to text-only HWL. Those exposed to highly severe pictorial HWL similarly rated the pictures to be more graphic than those exposed to moderately severe pictorial HWL ($P < 0.1$).

Main effects

The ANCOVA revealed differences among HWL for fear, avoidance, reactance and acceptability, but not attitude, intention, or motivation. *Post hoc* test using least significant difference showed that those exposed to highly severe ($P < 0.001$) and moderately severe ($P < 0.001$) pictorial HWL were more likely to experience fear than those exposed to text-only HWL. However, there was no evidence that the highly and moderately severe conditions differed. Likewise, participants exposed to highly severe

Table 1 Means, standard deviation and one-way ANCOVA for manipulation check and outcome variables

Measure	Text-only HWL ($n = 39$)		Moderately severe HWL ($n = 43$)		Highly severe HWL ($n = 45$)		F (2, 119)	η_p
	Mean	SD	Mean	SD	Mean	SD		
Manipulation check	3·23	2·07	7·42	1·89	8·20	2·03	65·84***	0·53
Outcome variables								
Fear	3·74	1·14	5·05	1·40	5·18	1·26	14·93***	0·20
Avoidance	2·40	1·10	3·87	1·09	4·06	0·90	33·12***	0·36
Reactance	2·70	0·96	3·28	0·91	3·59	0·75	13·72***	0·19
Attitude	4·43	0·76	4·64	0·54	4·55	0·65	1·12	0·02
Intention	4·74	1·42	4·71	1·35	4·97	1·25	0·53	0·01
Motivation	3·38	1·02	3·56	0·98	3·73	1·04	0·84	0·01
Acceptability	5·03	1·56	4·07	1·70	4·05	1·73	5·16**	0·08

HWL, health warning label.
**$P < 0.01$.
***$P < 0.001$; η_p, partial eta-squared. All ANCOVA results include age, gender, dieting and family diabetes as covariates. The score range for the manipulation check measure (how graphic participants perceived the HWL to be) is 1 (not at all) to 10 (extremely). The score range for the avoidance, reactance, attitude and motivation measures is 1–5. The score range for the fear, intention and acceptability measures is 1–7. Total n 127. While there were no missing data on the main outcome variables, there was one case of missing data for age, which was added as one of the covariates. Due to the very low level of missing data (no more than 1 % participants), we employed complete-case analyses by casewise deletion.

($P < 0.001$) and moderately severe ($P < 0.001$) pictorial HWL had stronger avoidance towards the HWL than those exposed to text-only HWL, but no evidence that the two pictorial conditions differed. For reactance, those in the highly severe ($P < 0.001$) and moderately severe ($P = 0.01$) pictorial HWL conditions reported greater reactance than those in the text-only HWL condition. There was also weak evidence that highly severe pictorial HWL resulted in greater reactance than moderately severe pictorial HWL ($P < 0.1$). For acceptability, participants exposed to highly severe ($P < 0.01$) and moderately severe ($P < 0.05$) pictorial HWL were less likely to accept the HWL than those exposed to text-only HWL, but there was no evidence that the two pictorial conditions differed.

Fear as mediator

Fear was found to have a mediating effect on the relationship between HWL severity and avoidance, reactance, intention and motivation (Table 2), but not for attitude and acceptability. Exposure to more severe HWL was indirectly linked to avoidance and reactance through fear. More severe HWL were associated with greater fear, which, in turn, was linked to greater avoidance and reactance. More severe HWL were also directly associated with greater avoidance and reactance even after controlling for the effect of fear.

Exposure to more severe HWL was also indirectly linked to intention to reduce the consumption of SSB and greater motivation to consume less SSB through fear. More severe HWL were linked with greater fear, which was in turn associated with greater intention and motivation. The direct effect between HWL and intention and motivation, however, was not significant.

Discussion

This exploratory study aims to examine the extent and mechanism of the effects of HWL of varying formats (pictorial/text-only) and severity on responses towards the HWL and SSB consumption through a randomised experiment. Findings indicate that pictorial HWL resulted in stronger fear, avoidance and reactance as well as lower acceptability of the HWL than text-only HWL. Between moderately and highly severe pictorial HWL, there was no evidence of an effect on these responses, except weakly for reactance. The results also showed that fear mediated the effect of severity on avoidance, reactance, intention and motivation, but not attitude or acceptability.

Our findings generally align with the tenets of fear appeals. As we did not include efficacy messages in our HWL, participants likely faced a high threat/low efficacy situation that arouses fear and activates avoidance and reactance[11,12]. Our results not only echo Hall et al.'s[14] finding that pictorial HWL led to greater reactance than text-only HWL but also add to existing literature by demonstrating that pictorial HWL led to greater avoidance in the context of SSB.

Interestingly, while there was no evidence that different levels of content severity in pictorial HWL on SSB influenced avoidance or fear in this study, there was weak evidence of their effect on reactance. This differs from Sillero-Rejon et al.'s[8] study on alcoholic drinks, where highly severe HWL increased both reactance and avoidance to a greater extent than moderately severe HWL. One possible explanation is the different contexts. Compared with alcohol, SSB may be viewed as a less serious health threat. As such, people may be less likely to fear the consequences of consuming SSB or to avoid SSB HWL,

Table 2 Mediation analysis of fear in the relationships between HWL with varying content severity levels and the outcome variables of avoidance, reactance, intention and motivation

Outcome variables	Effect of IV on mediator (a)	Unique effect of mediator (b)	Indirect effect (ab)	Direct effect of the IV on the DV (c')	Total effect of the IV on the DV (c)	95 % BC CI Lower, Upper
Avoidance	0·71***	0·35***	0·25	0·61***	0·85***	0·104, 0·419
Reactance	0·71***	0·17**	0·12	0·38***	0·50***	0·029, 0·225
Intention	0·71***	0·20*	0·14	−0·03	0·11	0·006, 0·298
Motivation	0·71***	0·39***	0·28	−0·13	0·15	0·140, 0·444

HWL, health warning label; IV, independent variable, that is, HWL in varying severity levels; DV, dependent variable. BC CI, bias-corrected CI.
BC CI of each indirect effect are based on 5000 samples. All coefficients reported for paths a, b and ab are unstandardised slopes. Total n 127. While there were no missing data on the main outcome variables, there was one case of missing data for age, which was added as one of the covariates. Due to the very low level of missing data (no more than 1 % participants), we employed complete-case analyses by casewise deletion.
*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.

while at the same time, be more easily annoyed at attempts to influence their freedom on SSB consumption.

The results also showed that pictorial HWL did not directly evoke attitude, intention and motivation. This aligns with the smoking cessation context[24]. Instead, pictorial HWL were found to indirectly increase intention and motivation by evoking fear. This indirect-only effect not only supports the psychological mechanism found in the smoking cessation context[7,21,24] but also demonstrates the importance of a mediation model in investigating the effects of HWL[20]. Our study also found that avoidance and reactance were evoked through the arousal of fear. Extending the mechanism proposed by Hall et al[22] to the SSB context, this finding suggests that although the arousal of fear may cause individuals to avoid thinking about the warning messages and reconfirm their own opinions and biases, it is also possible that it may cause individuals to try to avoid the HWL due to fear of the negative consequences of drinking SSB. Thus, in line with this study's finding on the effect of fear in enhancing intention and similar evidence in the smoking cessation context[22,23,25], pictorial HWL may still be effective at influencing healthier drink choices despite evoking avoidance and reactance. Additionally, pictorial HWL has been found to result in a 17 % reduction in the purchase of SSB[32], reinforcing its effectiveness.

Our findings also support the idea that effective HWL are often less acceptable[16,17]. Nevertheless, SSB warning labels with loss-frame messages, promoting messages similar to the HWL used in this study, have been proven more effective than gain-frame messages[33]. Therefore, instead of avoiding such graphic HWL, the task at hand, perhaps, is to discover ways of increasing HWL acceptance, for instance, by complementing it with effectiveness information[27].

This study is not without limitations. First, power analysis was not conducted *a priori* for this study and the sample size for this study is small. As such, the lack of differences between the three experimental conditions in some of the variables of interest could have been due to this study being underpowered to detect differences. Nonetheless, the study's exploratory findings were largely aligned with existing studies, providing some support for their validity and for this study's contribution to the limited SSB HWL literature in Asia[9]. Future studies can thus continue to explore the extent and mechanism through which HWL of different formats (pictorial/text-only) and severity may affect SSB consumption using larger sample sizes. Second, it should be noted that while mediation analysis implies causality, the design of this study and the associations seen in our exploratory findings is cross-sectional. Third, this study relied solely on self-report measures. To complement the study's exploratory findings, future research could look into other measurements, for example, actual behaviour[34] and implicit responses[35,36]. Lastly, the other threat component of fear appeal,

susceptibility, was not examined in this study. Investigating the effect of varying levels of susceptibility, on its own as well as alongside different levels of severity, could further inform HWL design.

Nonetheless, findings from this exploratory study contributes towards understanding health behaviour change and offers guidance for policymakers in efforts to reduce SSB consumption in the fight against diabetes and obesity. Although the fear evoked by pictorial HWL may, at first impression, elicit negative reactions, including reduced acceptability of the HWL, it may not necessarily be a bad thing as the elicited fear can help to drive healthier beverage consumption behaviours. While this tension between acceptability and effectiveness may give policy-makers pause when considering adopting graphic HWL as a strategy for reducing SSB consumption, HWL may possess other benefits of being simpler, clearer and easier to comprehend compared with other strategies like traffic light labels[37]. Therefore, graphic HWL should not be dismissed too quickly when considering strategies for reducing SSB consumption.

Conflict of interest

There are no conflicts of interest

Authorship

Both authors contributed to the manuscript equally. S.M.: conceptualisation, methodology, formal analysis, writing – original draft, writing – review and editing. O.Z.: conceptualisation, methodology, investigation, writing – original draft, and writing – review and editing.

Ethics of human subject participation

This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving research study participants were approved by the Wee Kim Wee School of Communication and Information, Nanyang Technological University Institutional Review Board (IRB# ICA201920S2-009). Written informed consent was obtained from all subjects/patients

Supplementary material

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