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Title

Effect of health-promoting messages in television food commercials on adolescents' attitudes and consumption: a randomized intervention study.

Author names and affiliations

Carlos Fernández-Escobar^{a*}, Doris Xiomara Monroy-Parada^b, Elena Ordaz Castillo^c, David Lois^d, Miguel Ángel Royo-Bordonada^e.

^aEscuela Nacional de Sanidad, Instituto de Salud Carlos III. Calle Sinesio Delgado 10, 28029 Madrid, Spain. E-mail: carlos.fe.es@gmail.com

^bEscuela Nacional de Sanidad, Instituto de Salud Carlos III. Calle Sinesio Delgado 10, 28029 Madrid, Spain. E-mail: doxiomonpal@gmail.com

^cEscuela Nacional de Sanidad, Instituto de Salud Carlos III. Calle Sinesio Delgado 10, 28029 Madrid, Spain. E-mail: eordaz@isciit.es

^dSocial Psychology Department, Universidad Nacional de Educación a Distancia. Calle de Juan del Rosal, 10, 28040 Madrid, Spain. E-mail: davidlois@psi.uned.es

^eEscuela Nacional de Sanidad, Instituto de Salud Carlos III. Calle Sinesio Delgado 10, 28029 Madrid, Spain. E-mail: mroyo@isciit.es

*Corresponding author.

Competing interests

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1. Introduction

In Spain, the prevalence of overweight and obesity in children aged 5 to 14 years is 20.7% and 9%, respectively (Ramiro-González et al., 2017). In the 8- to 13-year age group, the prevalence of overweight is 25.3% and that of obesity is 9.6% (Sánchez-Cruz et al., 2013). The main determinant of childhood obesity is the intake of ultra-processed foods and sugar-sweetened beverages, which are mass-produced, distributed, and continuously promoted by sophisticated marketing campaigns (Kelly et al., 2019; Swinburn et al., 2011).

In Spain, children aged 7 to 12 years watch a mean of 18 television (TV) advertisements for unhealthy food and drinks every day (Royo-Bordonada et al., 2016). This advertising influences their food attitudes and preferences, nutritional knowledge, and purchasing requests (Cairns et al., 2013), which results in increased consumption of the foods advertised and calorie intake, causing overweight and obesity (Russell et al., 2019). Among other persuasive techniques, indiscriminate use of emotional appeals contributes to the fact that children show more favorable attitudes towards the foods promoted (Dixon et al., 2007). The so-called “health halo” has been defined as a cognitive bias in which an explicit or implicit claim about a healthy quality of a given product induces a positive impression of it in the recipient of the advertising message (Harris et al., 2017), through evaluative conditioning of stimuli (Bohner & Dickel, 2011). This health halo can be achieved by means of different nutritional marketing techniques (health claims, references to healthy or natural products, images of active people in a good state of health, etc.) (Castonguay, 2015; Dixon et al., 2014; Harris et al., 2011; Soldavini et al., 2012; Sütterlin & Siegrist, 2015), which confuse consumers when used in the advertising of unhealthy foods (Whalen et al., 2018).

In recent years, some governments have inserted health-promotion messages into food and drink advertising. In France, for instance, it has been mandatory since 2007 for advertisements of unhealthy foods to display health-promoting messages that encourage regular exercise and the consumption of fruit and vegetables, a policy shown by a recent survey to be favorably rated by the population aged 15 years or over (INPES, 2008). Although 20% of the sample reported having changed their dietary habits thanks to the campaign’s health-promoting messages, a message encouraging the consumption of fruit in advertisements for a fruit-flavored yoghurt led 44% of interviewees to think wrongly that this yoghurt provided a serving of fruit, suggesting some potential negative effects of such policies.

The year 2013 saw the implementation in Spain of the so-called HAVISA plan (*Hábitos de Vida Saludables en la Población Española*) to foster healthy lifestyles in the Spanish population (AECOSAN, 2013), the result of a collaboration agreement between the Spanish Food Safety Agency (*Agencia Española de Seguridad Alimentaria y Nutrición/AESAN*) and leading food and drink producers. It involves a campaign with rotating health-promoting messages superimposed at the foot of TV food and drink commercials, e.g., “walk 30 minutes a day” and “eat more fruit and vegetables”, along with the address of a website with the same messages recorded in short videos (<20 seconds) by top sports celebrities.

The effects of these health-promoting messages have not been studied to date. Accordingly, this intervention study evaluated the possible health halo effect of HAVISA messages on adolescents aged 11 to 14 years, as well as their influence on participants’ immediate food choices and predisposition towards healthy eating habits and physical activity.

2. Methods

2.1. Design

We conducted a randomized, parallel-group, controlled intervention study on the effect of exposure to HAVISA messages carried in TV advertisements for unhealthy foods on children in their first and second years of compulsory secondary education (*Educación Secundaria Obligatoria/ESO*) (age range 11 to 14 years). At this age, children possess a certain degree of decision-making autonomy in regards to their own health as well as the necessary intellectual maturity to discern advertising, though not always to appreciate its persuasive intent (Carter et al., 2011).

2.2. Pilot study

On 4 December 2018, a pilot study was undertaken in two classrooms (intervention and control) belonging to a secondary school in Coslada (Madrid, Spain) with a sample of 60 pupils, to put the study procedures to the test. Following the intervention, a focal interview was conducted with 8 of the participants, purpose-chosen to form a diverse group in terms of sex, age, and nationality. This interview served to assess the length, duration, comprehensibility, and appropriateness of the questionnaires, and indicated the need to make some small amendments. A note was also taken of suggestions regarding the content of the videos shown in the intervention and the variety of foods offered afterwards.

2.3. Participants

A total of 857 1st- and 2nd-year pupils attending 3 secondary schools (*Instituto de Educación Secundaria*) in the town of San Fernando de Henares (Madrid) in the 2018-2019 academic year were invited to participate in the study. In November 2018, a letter of invitation was sent via the school teaching staff to all pupils and parents, informing them of the general objective of the study (to analyze participants' attitudes to and opinions of certain foods), without revealing the study's experimental nature, in order to avoid response biases due to knowledge of the intervention. This letter was accompanied by an explanatory note and an informed-consent form for signature by participants and parents alike, along with the baseline questionnaire on socio-demographic data and health habits, plus instructions on how to measure children's weight and height at home. Children with visual or intellectual disability and those who failed to complete the baseline questionnaire were excluded from the study.

2.4. Allocation and masking of the intervention

Based on the nominal list of candidates, the researchers established individual alphanumeric identification codes for all pupils, which were then used in the questionnaires instead of names to maintain anonymity. Once the signed consent forms and baseline questionnaires had been received, the researchers drew up an anonymized list with the identification codes of all pupils who agreed to participate in the study. Listed participants were centrally allocated to the intervention or control groups by simple randomization using a computer-generated sequence of pseudo-random numbers. Anonymity was then removed to generate the nominal lists of pupils allocated to each group. In co-ordination with the school staff, the participants in each arm of the trial were distributed into subgroups of a maximum of 33 pupils, according to the respective classroom availability and capacity of the school at which the intervention was being implemented. The participants and the teachers responsible for supervising them during the implementation of the intervention were blinded to the experimental nature of the

study, information which was later revealed.

2.5. Intervention

The intervention consisted of watching a video of a five-minute cartoon with two advertising breaks, each of which included two commercials for unhealthy food and drinks, with HAVISA health-promoting messages superimposed in white text on a narrow horizontal black strip at the bottom of the commercial, imitating real-life HAVISA messages. These advertisements were recorded from recent TV broadcasts made in Spain during the study period. The advertising breaks included other commercials unrelated to food and drink, which did not mention diet, physical activity, or health in general.

The selected advertisements promoted *Chips Ahoy* biscuits and *Huesitos* bars, two products which are unhealthy according to the nutrient profile issued by the World Health Organization (WHO) Regional Office for Europe (WHO Regional Office for Europe, 2017), which is designed to regulate food and drink advertising targeted at children. The health-promoting messages in the advertisements were “Eat more fruit and vegetables” (*Come más fruta y verdura*) and “The best formula: balanced diet and physical exercise” (*La mejor receta: alimentación equilibrada y ejercicio físico*) respectively, followed in both cases by the address of the HAVISA website (www.habitosdevidasaludables.com). The participants allocated to the control group watched an identical video containing the same advertisements in the same order but without the HAVISA messages superimposed on the black strip. On 14 March 2019, the intervention was simultaneously implemented at three secondary schools. The management team at each school distributed the pupils into pre-designated classrooms, each fitted with projection equipment to screen the video corresponding to the appointed group. The teachers in charge of the screening received detailed written instructions on how to supervise the whole process and attended a face-to-face training session with the researchers, during which they were able to raise queries. Throughout, however, they were kept ignorant of the experimental nature of the study, an aspect that was finally revealed to them after the intervention had terminated. When the screening had ended, the participating pupils completed the post-intervention questionnaire and left the classroom one by one. Placed outside each classroom, there was a table laid with ten types of food: five healthy (bananas, tangerines, dehydrated peaches, grapes and nuts), and four unhealthy products (cookies, chocolate bars, chocolate candy, chocolate palms, and salty bread crackers). Every pupil was asked to choose a single product, freely, without the presence of any teacher or researcher who might influence his/her decision, and then to proceed to the exit to hand in the questionnaire. Waiting at the end of each corridor, on the stairway landing, and in the entry hall on the ground floor was a researcher tasked with collecting the questionnaires and making a note on each one of the respective participant’s choice of product (healthy vs. unhealthy). The intervention simultaneously started at 10 am in all three schools, an hour before the customary 30-minute break, when the students usually have a mid-morning snack, and was consistently managed across the intervention and control groups.

2.6. Data-collection and study variables

The baseline questionnaire collected socio-demographic data (sex, age, nationality, educational level of parents, and composition of the household), as well as data on the presence of dietary restrictions (allergies, intolerances, ethical or religious reasons, or reasons of any other type) and health-related habits. Diet was assessed using the KIDMED

questionnaire on childhood adherence to the Mediterranean diet (Serra Majem et al., 2004), a simple instrument consisting of 16 items, each scored with 1 point: 12 positives (fruit; vegetables; fish; legumes; pasta or rice; cereals; nuts; olive oil; and dairy products) and 4 negatives (fast food; industrial pastries, cookies, biscuits and cakes; sweets and confectionary; and not eating breakfast). The total score, calculated by summing all the items, ranges from 0 to 12 points. Physical activity was assessed with a question about the number of days in the week devoted to doing a minimum of 60 minutes of vigorous physical activity. Participants were also asked about the how many hours of sleep they got and how many hours they spent using a TV, computer, tablet and/or mobile telephone per day (during the week and at the weekend), the presence of a TV set in the bedroom, and possession of a personally owned computer, tablet and/or mobile telephone. In addition, the questionnaire included instructions to participants' parents on how to measure their children's weight and height. The questionnaire to measure the effect of the intervention, which was individually completed *in situ* on termination of the screening of the commercials, collected data on attitudes (desire, perceived healthiness) and intention to consume the products advertised, using a five-point Likert scale with symbols of a happy ("smiley") or sad face to make the scale easier to understand; this same scale was also used to collect data on attitudes to diet and physical activity. To avoid a possible ceiling effect in questions about the importance of a healthy diet and physical exercise, generic questions were avoided, and pupils were instead asked about the specific importance they attached to these factors in their daily lives. Data were also collected on the reach and recognition of HAVISA messages. Lastly, when the completed questionnaires were handed in, a note was made on each of food chosen by the participant after the intervention had finished.

2.7. Statistical analysis

We performed a descriptive analysis of the socio-demographic variables and baseline health habits. The Student's t-test and Mann-Whitney U-test were used to evaluate the effect of the intervention on the desire for, perceived healthiness of, and intention to consume the products advertised, and yielded identical results, with the difference of means between the intervention and control groups being shown. The same method was applied to evaluate the effect on the perceived importance of food and physical activity, and the intention to improve in these habits. To evaluate the effect on the choice of snacks, the Chi-squared test (χ^2) was applied. Lastly, we calculated the percentages of participants who identified the presence of a message and recognized its text, using equivalent multiple-choice questions with only one valid response. Both the hypotheses and the analytic plan were specified before the data were collected. Additionally, post hoc analyses were conducted for those participants who correctly recalled the HAVISA messages, using logistic regression models adjusted for all basal variables.

2.8. Ethical aspects

This study complied with the principles of the Helsinki Declaration, the Council of Europe's Convention on Human Rights and Biomedicine and the UNESCO Universal Declaration of Human Rights, and adhered, insofar as it was applicable, to the Royal Decree 1990/2015 governing clinical drug trials in Spain. The study was approved by the Research Ethics Committee of the Carlos III Health Institute. All participants and their parents gave their written informed consent. On termination of the intervention, the participants, and the teachers in charge of supervising the intervention were informed of the experimental nature of the study, both verbally and in writing.

Of the 857 registered pupils, 573 (66.9%) agreed to participate and were randomly allocated to the arms of the trial as follows: 293 to the intervention group and 280 to the control group. On the date of the intervention, 26 (8.9%) pupils in the intervention group and 19 (6.8%) in the control group did not attend school, thus yielding a final sample of 528 participants, 267 and 261 in the respective groups (Figure 1).

The breakdown showed that participants' mean age was 12.85, 52.5% were girls, and 11.5% were of foreign nationality (Table 1). The mean BMI was 20.1 kg/m², with 17% of participants having overweight and 3.2% obesity as defined by the International Obesity Task Force (IOTF) standards (Cole et al., 2000). The mean KIDMED score was 5.8 over a maximum of 12, and 12.7% of participants reported some food allergy or intolerance. A mean of 3.5 days per week were devoted to doing a minimum of one hour of vigorous physical activity. The participants slept for a mean of 8.6 hours per day and watched TV for an average of 1.99 hours per day. The participants' characteristics were remarkably similar in both groups (Table 1), as were the characteristics of those who were absent on the day (data not shown).

A total of 27.2% of the control group chose a healthy snack as compared to 29.6% ($p=0.54$) of the intervention group (Table 2). No statistically significant differences were observed in the analyses by subgroup (data not shown). On a scale from 2 to 10, participants in both groups displayed a high desire for and intention to consume the unhealthy foods advertised: 7.24 (control) vs. 7.40 (intervention) in desire, and 6.67 (control) vs. 6.73 (intervention) in intention to consume; and a medium-to-low score in frequency of the type of consumption they considered advisable: 5.56 (control) vs. 5.51 (intervention); and perception of the healthiness of the foods: 4.11 (control) vs. 4.19 (intervention). On a scale of 1 to 5, the perceived importance of a healthy diet (3.17 in control group vs. 3.12 in intervention group) was less than the perceived importance of physical activity (control: 4.53, intervention: 4.51) and the desire to do physical activity (control: 3.95, intervention: 4.04). Desire for vegetables (control: 2.49, intervention: 2.66,) was lower than the desire for fruit (control: 3.15, intervention: 3.30). The small variations observed between the two groups were not statistically significant. However, the differences in desire for fruit and vegetables consumption were close to the significance threshold, favoring the intervention group by 0.15 points ($p=0.09$) and 0.17 points ($p=0.08$) out of 5, respectively.

With respect to the reach of health-promoting messages, 47.6% of the intervention group were aware of their presence and 39.2% of the control group erroneously reported that the advertisements contained superimposed messages ($p=0.12$) (Table 3). Of the intervention-group participants who reported noticing the presence of a superimposed message ($n=127$), 30.7% recalled at least one correct message of the two shown and 14.1% identified the correct website (Table 4). Hence, an overall 15% and 6% of intervention-group participants correctly recognized one or more messages or the HAVISA website address, respectively. Post hoc analyses restricted to the participants who recognized at least one correct message ($n=39$) showed that they were more inclined to choose a healthy snack option (46.2% did, vs. 26.8% of the 228 participants of the intervention group who did not see or recognize any message, crude OR=2.35, CI 95%= 1.17 – 4.70, $p=0.02$). Those who recognized the messages gave more importance to physical activity as well (4.72 points vs. 4.48 of those who did not, $p=0.02$). When adjusted for all basal variables, the association between recognition of the messages and the snack choice became non-significant (OR=1.69, CI95%= 0.76 – 3.78,

263 $p=0.20$).

264 4. Discussion

265 The participants in both groups exposed to advertising of unhealthy foods displayed a high
266 desire for and intention to consume the foods advertised, and a majority (approximately 7 out
267 of 10) chose unhealthy processed snacks instead of fruit or nuts, without significant
268 differences between the groups. Similarly, no differences were observed in the desire for
269 physical activity and the perceived importance of a healthy diet or physical activity. However,
270 desire for fruits and vegetables was slightly higher in the group who watched the health-
271 promoting messages, although the difference failed to reach statistical significance. The reach
272 of the messages in the intervention group was less than 50%, and less than one third of these
273 participants remembered correctly one or more of the superimposed texts or the HAVISA
274 website address. All in all, this suggests that the health-promoting messages used in the
275 HAVISA initiative have little to no effectiveness in changing health-related attitudes or
276 behaviors after a brief intervention in adolescents. This lack of effect may be partially driven
277 by the low recognition of the messages, given that those participants who did recognize them
278 tended to choose more frequently the healthy snacks, although no differences were found in
279 their declared food attitudes or desires.

280
281 A French study using an eye-tracking system demonstrated children's low attention to food
282 and health-promoting messages inserted into commercials (Lacoste-Badie et al., 2019): 57.1%
283 of participants focused their eyes on the message at least once, but only 19% for long enough
284 to read it, figures slightly higher than the 47% and 15% of participants in our study who
285 respectively recognized a message and recalled its content. This variation might be due to the
286 different methodologies and to the fact that both the number of advertisements and the time of
287 exposure were greater in the French study. In a similar experiment to ours, but with an
288 advergaming instead of television advertisements, only 31% and 4% of Spanish child
289 participants recognized the existence of a message and remembered its content, respectively
290 (Folkvord et al., 2017). As in our study, no differences were observed in attitudes towards the
291 products advertised or in the consumption of processed snacks, a result in line with the slight
292 reach and recall of such messages (Folkvord et al., 2015). Erroneous identification of
293 messages by some of the control-group participants might be attributable to them becoming
294 used to message superimposition under routine TV broadcasting conditions.

295
296 The absence of a health halo effect in our brief intervention could be explained given the
297 small reach of the messages, possibly due to their secondary position in the screen, and their
298 bland format and content, all factors that reduce their salience and appeal. In contrast, the use
299 of appealing health claims and idyllic images of nature or famous sportsmen and women are
300 usually centrally placed and clearly visible in the advertisement (Castonguay, J, 2015; H.
301 Dixon et al., 2014; Jennifer L. Harris et al., 2011; Soldavini et al., 2012; Whalen et al., 2018).
302 Although we did not ask the participants about their opinion on the placement and appeal of
303 the messages, the fact that those who did recognize them tended to choose more frequently
304 the healthy snacks might support this hypothesis.

305
306 The rationale of HAVISA health-promoting messages is to promote healthy eating. However,
307 in our brief intervention, desire for the unhealthy products advertised was very high and the
308 health-promoting messages failed to reduce it, to improve the target audience's predisposition
309 towards healthier eating and engaging in physical activity, or to increase their consumption of
310 fruit or nuts. We found a small, favorable effect on the desire for fruit and vegetables, but this
311 was not statistically significant and was not sufficient to change the food choices of the
312 participants. Evaluating the real-world effectiveness of a widespread initiative such as

HAVISA is beyond the scope of our research. However, other authors have raised doubts about the potential of these health-promoting messages to counteract the persuasive intent of advertising in a population with limited capacity to discern it (Carter et al., 2011; Lacoste-Badie et al., 2019), and several Spanish studies have raised concerns about the adequacy of the self-regulation approach (Ponce-Blandón et al., 2017) and the compliance to the HAVISA plan itself (Gómez & Díaz-Campo, 2014).

The proposal to include health-promoting messages in France was put forward by the industry as an alternative compromise in response to the Health Ministry's plan to ban the advertising of unhealthy foods targeted at children (Friant-Perrot et al., 2017). The selfsame strategy of corporate capture of public health has been pursued in Spain in recent years (Royo-Bordonada, 2019). In the face of the doubts about the effectiveness of the "PAOS Code of self-regulation of food advertising directed at children under the age of 12 years, prevention of obesity, and health" (*Código de Autorregulación de la Publicidad de Alimentos dirigido a Menores, Prevención de la Obesidad y Salud*), which has regulated food advertising targeted at children in Spain since 2005 (León-Flández et al., 2017), and the demands of health professionals and civil society for a regulation to ban the advertising of unhealthy food and drinks (del Pino & Royo-Bordonada, 2016), the food industry instead proposed an agreement with the Ministry of Health to incorporate health-promoting messages in food advertising. It may be that the industry has yet again succeeded in postponing the application of an effective regulation which would protect children from exposure to advertising of unhealthy foods, a measure that is also demanded by the WHO (World Health Organization, 2010).

4.1. Strengths and limitations

To our knowledge, this is the first intervention study to evaluate the effect of health-promoting messages contained in food and drink commercials targeted at children. A randomized controlled trial is the best-suited design to infer causality and to control for confounding factors usually present in observational studies. Another strength of the study is its large sample size. Furthermore, our results cannot be accounted for by a possible bias due to losses to follow-up, since this percentage was not only low but was also attributable to the same reason in both groups (unforeseen lack of attendance at school). This research, however, is subject to several limitations. First, it only evaluated the *immediate* effect of the intervention on perceptions, attitudes, and conduct (choice of snacks), and not the maintained effect on diet and habitual physical activity. However, those immediate effects are the hypothetical intermediate mechanisms responsible for changes in lifestyle and, ultimately, in health. Second, the lack of a baseline measure of health-related attitudes and food choices makes it more difficult to ascertain whether there was a change in perceptions and its direction. Nevertheless, the randomized nature of the experiment allows us to infer that the differences observed between the groups were due to the intervention. Third, the briefness of the intervention may be insufficient to shift deeply entrenched perceptions. This study was not able to accurately reproduce the advertising atmosphere to which children are repeatedly exposed in their daily lives, and it is therefore possible that longer interventions may have an effect not captured in this research. As far as the choice of the advertisements is concerned, the participants might have become habituated to the real-life commercials before, so their potential response to both the advertising and the health-promoting messages may be subdued. Furthermore, children's previous knowledge of the commercials was not measured. Even so, the advertisements chosen were recent to minimize the previous exposure to them. A non-differential social desirability bias may have occurred in the responses to the questionnaires, that might account for the absence of effect on the response variables.

However, the choice of snack was less likely to be subject to this bias, since it was made alone, without the conditioning presence of teachers or researchers. Finally, only television advertisements were evaluated, leaving out other major advertising channels (radio, Internet, mobile applications, etc.). Nonetheless, food commercials were mixed with those of other sectors and interspersed in a cartoon programme in two breaks, to make the intervention as realistic as possible.

4.2. Conclusions

The use of health-promoting messages in TV advertising of unhealthy foods did not modify the immediate attitudes or eating choices of adolescents, except for a small, non-significant increase in the desire for fruit and vegetables. Only a small percentage of participants correctly recognized the messages shown, which suggests that low prominence is partly to blame for health-promoting messages' lack of immediate effectiveness.

This research suggests that health-promoting messages have small to no positive immediate effects on health-related attitudes and food behaviors, and that they lack immediate negative, "health halo" effects. The evaluation of the overall effectiveness of health-promoting messages as an obesity prevention policy must be complemented with other studies, which should focus on the effects of long-term repeated exposure to these messages with varying degrees of salience and appeal, by making them more visible and centrally placed.

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6. Author contributions

CFE and MARB conceived the study. EO and DL participated in the study implementation. EO created and managed the database and conducted preliminary analyses. CFE made the main analysis and wrote the first draft of the manuscript, with support of DXM and MARB. All authors contributed to the revision and approval of the final manuscript.

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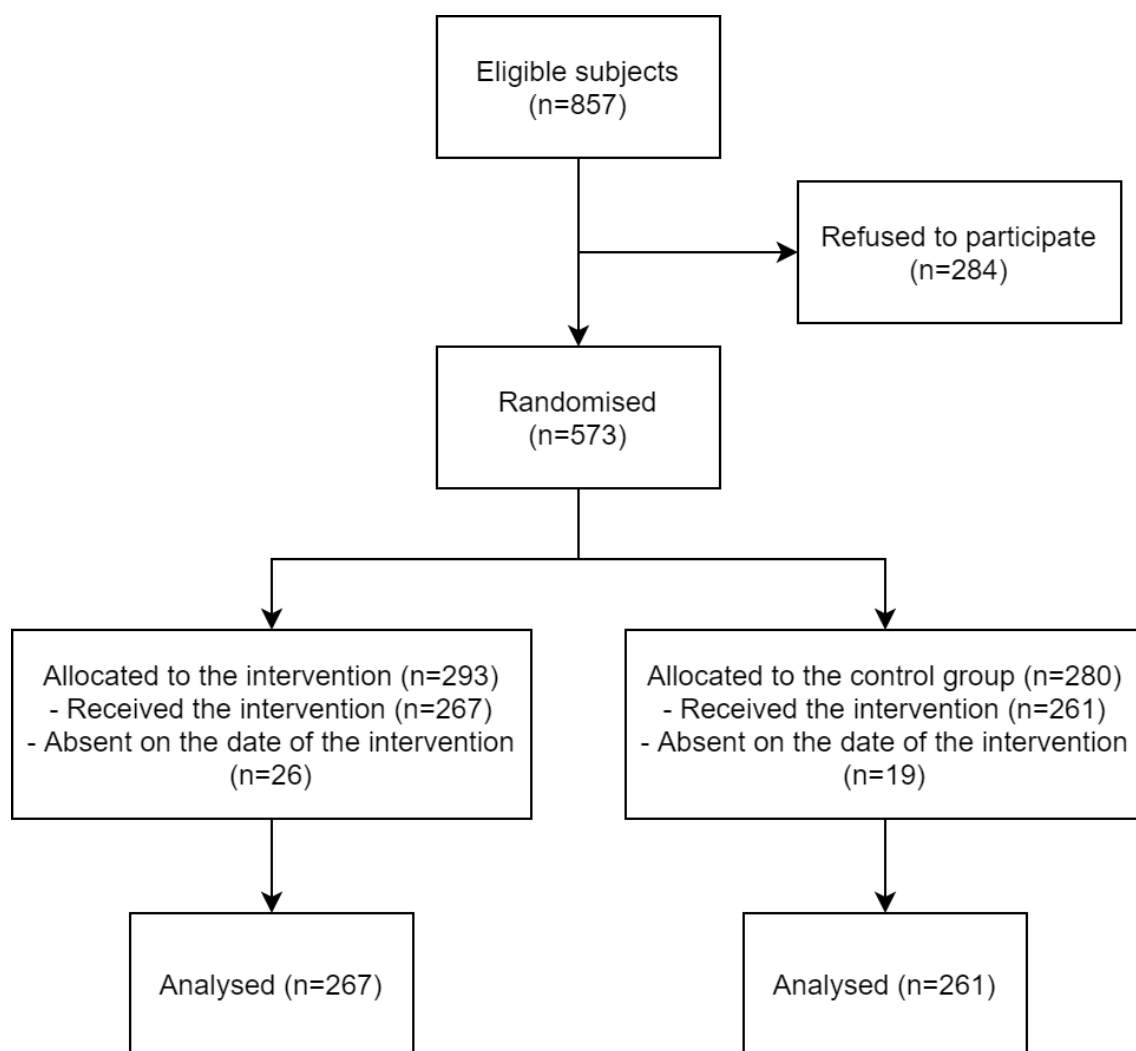
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526 **Figure 1. Flow chart of participants.**
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546 **Table 2. Main results of the intervention.**

Variable	Mean / %		Difference (95% CI)	<i>p</i>
	Control	Intervention		
Healthy choice	27.2%	29.6%	2.4 (-5.3 – 10.1)	0.54 ^a
Attitudes towards advertisements				
Desire*	7.24	7.40	0.16 (-0.14 – 0.46)	0.29 ^b
Perception of healthiness*	4.11	4.19	0.08 (-0.14 – 0.30)	0.47 ^b
Advisable frequency*	5.56	5.51	-0.04 (-0.28 – 0.20)	0.74 ^b
Intention to consume*	6.67	6.73	0.06 (-0.23 – 0.37)	0.63 ^b
Importance of a healthy diet [‡]	3.17	3.12	-0.05 (-0.19 – 0.10)	0.55 ^b
Importance of physical activity [‡]	4.53	4.51	-0.02 (-0.12 – 0.08)	0.73 ^b
Desire for physical activity [‡]	3.95	4.04	0.09 (-0.06 – 0.25)	0.23 ^b
Desire for fruit [‡]	3.15	3.30	0.15 (-0.02 – 0.31)	0.09 ^b
Desire for vegetables [‡]	2.49	2.66	0.17 (-0.02 – 0.36)	0.08 ^b

547 * Scale: 1-10.

548 [‡] Scale: 1-5.

549 ^a Chi-2.

550 ^b Student's t-test.

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Table 3. Reach of HAVISA messages.

	% of responses (message recognised)				<i>p</i>
	None	Black strip	Message	DK	
Control	5.4	5.4	39.2	50	0.12 ^a
Intervention	2.6	3.7	47.6	46.1	

552

DK: do not know. ^aChi-2

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Table 4. Recognition of HAVISA messages.		
	Text (N=127)	Website (N=114)
At least one correct message	39 (30.7%)	16 (14.1%)
No correct message	47 (37.0%)	29 (25.4%)
Do not know	41 (32.3%)	69 (60.5%)

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* Total percentage of participants who reported having noticed a message on the screen and answered the question about which message they had seen.