Influence of "health" versus "commercial" physical activity message on snacking behavior

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Abstract

Purpose – This study aims to investigate whether the effect of exposure to video communication displaying physical activity (PA) would affect viewers' snacking behavior depending on the type of message. Specifically, it is expected that food intake would be significantly higher when the message is labeled as a "commercial message" rather than a "health message".

Design/methodology/approach – Two experimental studies are conducted that manipulate the type of message (commercial message vs health message). In Study 1, the participants' level of involvement (low vs high) is also manipulated. In Study 2, the intensity of the PA displayed in the videos (low vs high) is manipulated, and a control group is included. The main dependent variable is the number of sweets eaten while watching the ad.

Findings – Results from both studies show that the influence of a PA exposure on food intake is influenced by the nature of the communication. Participants exposed to the commercial message eat more sweets than those exposed to the health message ($\eta p^2 = 0.06$). Being exposed to a health message elicits self-regulated eating behaviors with no more sweets eaten than in the control group. In addition, the effect of the type of message is moderated by the intensity of the PA displayed. The difference of sweets consumed depending on the type of message is significant only when the physical intensity displayed is low.

Research limitations/implications – The present research emphasizes the moderating role of the type of communication on food intake when recipients are exposed to a PA message. Further research must be conducted to enlarge the understanding of the phenomenon considering other critical variables such as inter-individual differences (e.g. body mass index and self-regulation skills), types of food (e.g. healthy vs unhealthy) and other contexts (e.g. watching sports events on television).

Practical implications – The present findings have implications for marketers, health practitioners, policymakers and consumers. They stress the significance of how the implicit goals of the messages are taken into account within consumers' information processing and how this can affect subsequent consumption behaviors. PA displayed through a commercial message has the most negative impact on food intake, especially when the intensity of PA is low. PA displayed through a health message shows no impact on food intake, whatever the intensity of the PA. It emphasizes the importance of combining exposure to PA through advertising or sporting events to a message promoting healthy and balanced eating behaviors.

Originality/value – The value of the present research lies in an additional understanding of the complex effect of passive exposure to a PA message on subsequent food consumption. Furthermore, the present study expands research on persuasive communication and has critical implications for public health issues.

Keywords Behaviour change, Physical activity, Health message, Snacking, Commercial message

Paper type Research paper

Introduction

Consumers are frequently exposed to mass media health campaigns that promote physical activity (PA) (e.g. the NFL "PLAY 60" national youth health and fitness campaign launched in the USA in 2007) and to a bulk of advertisements developed by the sport and leisure industry that highlight PA as a way to improve well-being. Previous research has shown that in most cases, making the concept of PA salient to consumers increases the subsequent amount of food they ingested. Exposure to exercise health messages (Albarracin *et al.*, 2009), imagining exercising (Werle *et al.*, 2011) or watching a sports brand advertisement (Werle *et al.*, 2017) was followed by higher immediate food intake. In addition, some studies have demonstrated that variables such as the body mass index (BMI) or the perceived ease of the portrayed PA moderated the effect with a decrease in food consumption following exposure to exercise commercial ads for high BMI people (Van Kleef *et al.*, 2011), and when the portrayed exercise was perceived as difficult (Werle *et al.*, 2017).

Given the significance of the phenomenon, we were interested in investigating the moderating role of the nature of

communication on snacking behavior. Health messages and sports advertisements share common content about PA and are based on the same persuasion processes (Briñol *et al.*, 2015). Their goals and focus are nevertheless different. Health messages come from large public health programs and focus on self-control and/or adopting the recommended behavior, compared to commercial advertisements that are aimed to expand market shares of products and services and focus more on pleasure and immediate benefits. People are aware of these differences (Wright, 2002), and this knowledge is likely to prime self-regulation behaviors when exposed to a health message versus reward impulsive behaviors when exposed to a commercial message. Therefore, it is hypothesized that viewers exposed to a message labeled as a "commercial ad," designed to trigger impulsive behaviors, will consume a larger amount of food (snacking) than viewers exposed to the same message labeled as a "health message," whose main goal is to trigger healthy responses and activate self-regulation behaviors.

Theoretical framework

Along with basal metabolic need, PA is the main antecedent of food intake as energy expenditure is compensated for by energetic inputs and nutrients found in food (Martins *et al.*, 2007). This link between physical energy expenditure and food intake is physiologically grounded and regulated by cognitive, affective and social factors. For example, food intake can be experienced as a reward after an effort. According to the compensatory health beliefs model (*Rabiau et al.*, 2006), people may believe that engaging in positive and normative behaviors (e.g. practicing PA) can allow them to be more open to subsequent indulgent behaviors (e.g. to increase their tasty food intake or snacking). Also, the labeling of PA matters. Participants consumed a larger quantity of pleasant food if their actual PA (one-mile walk) was labeled as an "exercise walk" rather than a "scenic walk" (Werle *et al.*, 2015).

The effect of physical activity exposure on food intake

The link between physically energetic expenditure and food intake to compensate for the physical effort is also observed through passive exposure to PA. For instance, participants exposed to health messages that advertised exercise or exposed to subliminal words linked to PA (e.g. active) ingested more calories than participants of a control group (Albarracin *et al.*, 2009). The same effect, as a trend, was observed when participants were exposed to a Nike sports advertisement displaying people engaged in exercise compared to a control commercial ad (Werle *et al.*, 2017). In another study, participants asked to read about PA (i.e. a scenario describing a 30 min walk) ingested more calories than participants in the control group (no scenario; Werle *et al.*, 2011). One of the reasons accounting for the phenomenon may be the activity of mirror neurons that modulate both when an individual executes a specific motor act and when he/she observes the same act performed by another person (Di Pellegrino *et al.*, 1992; Keysers and Gazzola, 2010). So watching, reading or even imaging another person involved in a PA will make an individual experience the same action without actually performing it. Then subsequent food intake, as a compensatory behavior for energy expenditure, is likely to be observed afterward. Yet, moderators are likely to counteract this effect. A reduction of food intake was observed following exposure to commercial ads related to exercise equipment or fitness services in comparison to commercials that were not related to physical activities but were among participants with a high BMI (Van Kleef *et al.*, 2011). In another study, the perception of easiness of the portrayed exercise in an ad was shown to be a moderator of food intake. People ate less when the exercise was perceived as difficult (Werle *et al.*, 2017).

Communication's goal as a moderator of the effect of physical activity exposure on food intake

In the present study, we were interested in investigating the effect of exposure to PA on food intake according to the goal of the communication. Beyond PA, the goal of messages to which recipients are exposed to must be taken into account. An important argument in this domain is that people have a lay knowledge about the advertiser's intent in communication (Wright, 2002). People do know that a commercial advertisement's first intent is to promote a specific product, whereas health communication's first intent is to promote healthy behaviors.

Commercial advertising is designed to trigger buyers' impulsive behaviors that are oriented toward consumption rewards and short-term hedonic self-fulfillment. Watching television (TV) ads promoting snacks automatically increases the amount of snacking among children, as well as adults (Harris *et al.*, 2009), suggesting that these ads may promote short-term enjoyment goals in general, to the detriment of longer-term healthy living goals (Chandon and Wansink, 2011). Positive attitudes toward advertising can even lead to compulsive buying behaviors (Mikołajczak-Degrauwe and Brengman, 2014). Food advertising has shown a direct link to obesity by triggering automatic snacking (Harris, 2008). Interestingly though, when the food ad was associated with a nutrition message (likely to increase the accessibility of a health-oriented motive), it inhibited automatic consumption tendencies. This finding shows that when mentally accessible, an abstract goal may be sufficient to enhance self-control and inhibit snacking behavior even when this goal is not related to the food domain (Price *et al.*, 2016). Therefore, it is probable that exposure to PA through a commercial message also automatically triggers impulsive subsequent food intake. At first sight, the Van Kleef *et al.*'s findings (2011) mentioned above did not argue in favor of this assumption, as the exposure to commercial advertisements did reduce food intake for high BMI people. However, the ads used as experimental material stressed ideal bodies (i.e. gaining muscles, getting a toned and skinny body) and the benefits of doing sports. This kind of message promoting a healthy life is also likely to generate associated cognitions about consuming more (less) healthy (unhealthy) food, especially among the potentially most concerned participants (e.g. people with high BMI). This high-level goal (i.e. be in good health) has more weight than passive exposure to physical exercise itself. People are able to infer that beyond the promotion of a specific product, a commercial ad

can promote a healthy lifestyle that mixes both physical exercise and a healthy diet.

Health messages are designed to trigger the implementation of adapted and healthy behaviors and intend to directly inhibit impulsive responses that are driven by environmental temptations (e.g. snacking). Subtly priming the goal of dieting via a poster message enhanced self-regulation of eating behaviors in a tempting food environment, beyond participants' conscious awareness (Papies and Hamstra, 2010). Self-regulation refers to the ability (or inability) to exploit cognitive, emotional and motivational resources to achieve goals. People are more or less able to control their thoughts, feelings and actions to achieve a specific goal or the desired outcome (Blair and Diamond, 2008; Mischel *et al.*, 1989). Exposure to communications (i.e. ads and magazines) promoting a healthy diet were shown to inhibit food intake among people paying attention to their weight (Anschutz *et al.*, 2008; Fishbach *et al.*, 2003). Overall, self-regulation is at the core of health promotion (Bandura, 2005; Bittner and Kulesz, 2015). A health message encouraging PA for being in good health not only promotes PA itself but also a set of self-regulation behaviors associated with health benefits beyond PA: favoring walking or biking on daily short trips and by association, eating in moderation and eating healthier food. This association is even likely to happen as health promotion of PA is often linked to recommendations about eating behavior, as an example the national French health program named "Manger–Bouger" ("Eat-Move") launched in 2001.

So given the specificity of either a commercial or a healthy communication goal, the following main hypothesis is stated:

H1. When exposed to a message displaying PA, a higher level of food intake is expected when individuals believe it is a "commercial message" rather than a "health message."

The extent to which self-regulated behaviors can be implemented may depend on the level of information processing while exposed to the health message. According to dual-process models of persuasion, people can process information superficially, based on peripheral cues or scrutinize the information in a more systematic and effortful way (Petty *et al.*, 2009). High elaboration processing is more consciously driven and occurs, for instance, when people are involved with the content of the persuasive message. So, enhancing the level of personal relevance in the message content should trigger a more deliberative and thoughtful process, leading to more controlled and goal-oriented behaviors related to "being in good health" when exposed to the health message. This is not to say that higher information processing is making people aware that watching PA can affect their subsequent food intake. But it is to say that more conscious self-regulated responses associated with being in good health such as eating less and better are likely to be seen more frequently when people are more involved in a health message promoting PA. However, when exposed to a commercial message, the level of involvement should not affect individuals' food intake as commercial ads trigger impulsive behavior toward consumption. Thus, the following hypothesis is stated:

H2. When exposed to a "health message," a lower level of food intake is expected when individuals are more personally involved by the message than less personally involved by the message.

In addition, people can be exposed to different kinds of PA or differences in the intensity of the PA displayed. A written scenario describing people walking or a triathlon event watched on TV does not display the same level of physical intensity. Given the literature, one of two contrasting results is likely to be observed for the manipulation of the PA intensity. Because energy expenditure is compensated for by food intake as a source of energy and nutrients, the higher the energy expenditure, the higher the subsequent food intake is likely to be. On this basis, exposure to an intense PA video should increase the amount of food intake in comparison to exposure to a soft PA video. However, literature has shown that a higher amount of food ingested is observed when participants are exposed to a message showing easy exercises rather than difficult ones (Werle *et al.*, 2017). The ease of imagining portrayed PA is thought to be the mediator of the relationship between type of advertisement (easy vs difficult) and food intake. In the present study, the manipulation is about the intensity of the PA (i.e. amount of effort and energy required to perform the PA), but this notion is strongly associated with the concept of difficulty. An intense PA requires higher effort than a low one, and thus, is implicitly more difficult to perform. Therefore, the following hypothesis is made:

H3. Participants exposed to a message displaying intense PA will ingest fewer sweets than those exposed to a message displaying low PA.

This effect is expected to be moderated by the type of message to which people are exposed. We expect no difference between the low and the intense PA video when the message is labeled as a "health" message; we hypothesize food intake to be controlled in this condition. However, those exposed to a "commercial" message triggering impulsive behaviors should ingest even more food compared to the "health" message when exposed to the low PA condition rather than the intense one. In other words, the difference in the amount of food ingested between the "health" message and the "commercial" message should be more important in the low PA condition than in the intense PA condition. Stated formally:

H4. A higher amount of food ingested in the "commercial" message condition in comparison to the "health" message condition will be observed when the message displays low PA. This difference should be smaller when the message displays an intense PA.

Two experiments were conducted to test these hypotheses. Both tested the main hypothesis about the moderating role of the type of communication, "commercial" or "health," on the influence of PA exposure on food intake (*H1*). In addition, the moderating role of involvement (*H2*) was tested in Study 1, and the main and interactional effects of the physical intensity displays in the message were tested in Study 2 (*H3* and *H4*).

Experiment 1

Method

Participants and design

In total, 106 undergraduates (84 female; M_{age} = 20.4) participated in this experiment for course credit. They have filled out a consent form according to the French national ethics code

of conduct in research in psychology and have been debriefed about the research afterward. Participants are randomly assigned to one of the four experimental conditions of a 2 (type of message: commercial message vs health message) × 2 (level of involvement: low involvement vs high involvement) between-subjects design. Test sessions will last two days, and students will participate in small groups. Gender is homogeneously distributed across the experimental cells.

Materials and procedures. Participants are settled in 1 of the 12 cubicles in the laboratory room. On the right side of the computer, a bowl of 30 colored sweets (Haribo Dragibus©; ca. 375 kcal/100g) is available. White tissue is available close to the bowl as a control material to separate food intake from object manipulation. Sweets are justified as rewards for participation. At the end of each session, the entire stock of sweets is completely renewed for hygienic reasons.

Next, participants are exposed to one of the messages presented as being tailored either too similar young French students living in the same area as themselves (i.e. high involvement condition) or being addressed to people from abroad (Finland) who are 40 years old or older (i.e. low involvement condition). The experimental video, lasting 1 min and 20 s, is made of sequences of intense sports activities (i.e. capoeira, running in hilly terrain, athletics activities and bodybuilding), performed by male and female characters. It is presented either as a draft of a TV spot designed to serve as an advertisement for sports equipment (i.e. "commercial message" condition) or as a draft of a TV spot designed as a health message for promoting PA (i.e. "health message" condition).

Dependent measures. After exposure to the message, participants complete a questionnaire. To both control the validity of the material and support the cover story, a general attitude toward the video and attitude toward the images used in the video (agreeable, attractive, aesthetic, bad [reversed score] and boring [reversed score]) are rated using five-point Likert scales (ranging from 1 "not at all" to 5 "completely"). The scores of the image video's items are averaged to create a video image attitude index ($\alpha = 0.83$). Participants also rate the extent to which the images used in the video are adapted for a TV spot (ranging from 1 "not at all" to 5 "completely").

Then, participants rate how much the message is likely to influence people to engage in sports activities, to influence their desire to be involved in sport, and how likely the message would convince people to buy sports equipment (ranging from 1 "not at all" to 5 "completely"). These measures, as part of the cover story, will not be further analyzed as they are of no interest to our research questions. Finally, participants indicate how much they are involved with the message (five-point scale ranging from 1 "not involved" to 5 "fully involved").

A few weeks before the study, participants' height and weight are reported in a mass testing questionnaire to calculate BMI (according to the World Health Organization, a normal BMI score ranges between 18.5 and 24.9). Their level of PA is also measured with the short version of the International PA Questionnaire (Hagströmer *et al.*, 2006). The seven items are about the number of days per week, as well as the time spent in minutes per day engaging in intense PA (e.g. high intensity aerobics, carrying heavy loads, biking fast, etc.), moderate PA (e.g. swimming slowly, playing doubles tennis, etc.) and light PA (e.g. slow walking). Each category is then multiplied by a specific metabolic equivalent of task (MET) coefficient, 8, 4 or 3.3 depending on the task, and sum to get an estimated MET. The MET is the measure of the ratio of the rate of energy expended during an activity to the rate of energy expended at rest, and is used as a unit of measure of the intensity and energy expenditure of activities. For instance, an individual doing 30 min of moderate activities 2 days per week will have an estimated MET score of: 2 (days) × 30 (min) × 4 (the MET reference for a moderate activity) = 240. The higher the score, the more physically active the individual is. A score of 300-6,000 MET is considered as a proxy of moderate activity.

Results

Manipulation check and controls

ANOVAs yield no differences between participants' BMI (F (1, 102) = 0.25; $p > 0.10$) and MET scores (F (1, 102) = 0.002; $p > 0.10$) across the experimental conditions (Table I). Mean scores show a normal average BMI's score (M = 21.6; SD = 3.1; min = 16.8; max = 31.2) and a moderate level of activity (M = 2,756.5; SD = 2,197.7; min = 66; max = 9,330). The participants' degree of involvement shows no difference between the high (M = 2.6, SD = 0.17) and the low involvement (M = 2.5, SD = 0.16) conditions, F (1, 102) = 0.02; $p > 0.10$.

Snacking is an unobtrusive measure, therefore a measure of participants' hunger state before the experimental session has not been introduced as it is likely to enlighten the participants about the true purpose of the experiment. Nevertheless, we have controlled the time of day (in France people have a small breakfast and a large lunch between 12 and 14 p.m.). As the experiments run all day long, we have checked whether the number of sweets eaten during the sessions is significantly influenced by the time of the day. Sessions are running during four different time periods: "morning" sessions (10 to 11:30 a.m.), "lunch" sessions (1 to 2:30 p.m.), "afternoon" sessions (3 to 4:30 p.m.) and "end of the day" sessions (5 to 6:30 p.m.). ANOVA shows a significant effect of the time of the session, F (3, 102) = 2.80; $p < 0.04$. Specifically, participants have eaten more sweets during the "end of the day" sessions (M = 12.3, SD = 2.24) than during the "morning" sessions (M = 3.9, SD = 1.88); post-hoc Tukey, $p < 0.02$.

Regarding the ecological validity of the experimental material, attitudes toward the images of the video

Table I Participants' means and standard deviations for BMI and metabolic equivalent according to the experimental conditions – Study 1

	Commercial message		Health message	
Measures	**Low involvement**	**High involvement**	**Low involvement**	**High involvement**
BMI	21.2 *(0.62)*	21.6 *(0.64)*	21.4 *(0.60)*	22.5 *(0.70)*
MET	3,267.5 *(449.8)*	2,779.1 *(440.7)*	2,670.0 *(440.7)*	2,223 *(492.7)*

($MS_{Commercial}$ = 3.6 (SD = 0.10) and MS_{Health} = 3.7 (SD = 0.11); F (1, 102) = 0.81, $p > 0.10$) and toward the video itself ($MS_{Commercial}$ = 3.6 (SD = 0.13) and MS_{Health} = 3.8 (SD = 0.14); F (1, 102) = 1.42, $p > 0.10$) are not significantly different between the message conditions. As a trend, a more favorable attitude toward the video is expressed by the participants in the high involvement condition (M = 3.9, SD = 0.14) compared to the low involvement condition (M = 3.6, SD = 0.13); F (1, 102) = 3.13, $p < 0.09$. Neither the involvement and the message main effects nor the interaction between message and involvement are significant regarding the fact that the images used in the video are adapted for a TV spot, $p_s > 0.10$. On average, the images are judged quite adapted for a TV spot (M = 3; SD = 1.1).

To check that food intake is not confounded with the desire to manipulate an object, we calculate the frequency of tissue taken. In total, 13 per cent (N = 20) have taken a tissue with no difference according to the message conditions, X^2(2, 104) = 3.82, $p > 0.10$ or the involvement conditions, X^2(2, 104) = 0.75, $p > 0.10$.

Sweets intake

Participants' BMI scores, MET scores and time session are introduced as covariates. Analysis of covariance (ANCOVA) reveals only a significant effect of the co-variable time session. A significant main effect of the message variable on intake of sweets is observed, F (1, 83) = 4; $p < 0.04$; η^2partial = 0.06, which indicates that participants exposed to the commercial message have eaten significantly more sweets (M = 10.2, SD = 1.5) than those exposed to the health message (M = 5.5, SD = 1.5), supporting *H1*. No main effect of involvement ($M_{Low\text{-}involvement}$ = 8, SD = 1.4; $M_{High\text{-}involvement}$ = 7.7, SD = 1.6; $p > 0.10$) or interaction effects are observed on the amount of sweets consumed (Table II), thereby not supporting *H2*.

Discussion

As expected, on the basis of the very same communication content (e.g. a PA video), higher food intake is observed when the communication is believed to be a commercial one rather than a healthy one, supporting *H1*. The expected influence of the level of involvement on food intake for individuals exposed to the video labeled as a health message is not observed (*H2*). However, no conclusion can be drawn about this result other than that the involvement manipulation did not work.

Following this study, a second one was necessary to confirm the main hypothesis (*H1*) and bring additional insights into the phenomenon. To validate our assumption that a health message activates self-regulated behaviors by inhibiting food ingestion following PA exposure more than a commercial message does, a control group was introduced. It was expected that in comparison to the control group, a higher number of sweets ingested would occur only when the participants were exposed to the message labeled as "commercial" (*H2a*). This difference would not be significant when the participants were exposed to the message labeled as a "health" message (*H2b*). In addition, Study 2 investigated the extent to which a difference in the intensity of the PA displayed can moderate the influence of exposure to a PA on food intake and according to the type of communication. It is expected that participants exposed to a message displaying intense PA will ingest fewer sweets than those exposed to a message displaying low PA (*H3*) and that a higher amount of food ingested in the "commercial" message condition in comparison to the "health" message condition will be observed when the message displays low PA. This difference should be smaller when the message displays intense PA (*H4*).

Experiment 2

Method

Participants and design

In total, 148 undergraduates (139 female; M_{age} = 19.6) have participated in this experiment for course credit and have been randomly assigned to one of the four experimental conditions of a 2 (type of message: commercial message vs health message) × 2 (intensity of the PA: high vs low) between-subjects design or to the control group.

Materials and procedure. The procedure and the sweets (Haribo Dragibus©) are the same as the ones used in Study 1. However, new experimental videos were created to manipulate the intensity of the PA presented to the participants. The high intensity experimental video comprised a sequence of intense sport activities, mostly performed by girls and boys running fast in different locations (i.e. hilly terrain, streets and stadium); the low intensity experimental video included a sequence of people walking in different locations (i.e. streets, countryside, and mountain) or practicing soft gymnastics (e.g. yoga and Pilates). The video for the control group had to be unrelated to PA and free of communications related to commercial or health issues. Consequently, we chose to realize a video made of sewing tutorial sequences, a creative activity that is popular among young people in France. All the videos last 2 min and are accompanied by the same subtle (computer sound volume of 15) and pleasant musical background to render the video drafts more credible[1]. As in Study 1, the experimental ones are presented either as a draft of a TV spot designed to serve as an advertisement for sports equipment (i.e. "commercial message" condition) or as a draft of a TV spot designed as a health message for promoting PA (i.e. "health message" condition). The control group video is presented as a draft for promoting sewing practice.

Dependent measures. Some measures are added to the original questionnaire. Participants are asked about their perception of the length of the video they are exposed to with an open-ended question; the intensity of the PA presented in the video (ranging from 1 "very weak" to 5 "very intense"); if they

Table II Means and standard deviations of sweets' intake according to the experimental conditions – Study 1

	Commercial message		Health message	
Measure	**Low involvement**	**High involvement**	**Low involvement**	**High involvement**
Sweet intake	10.47 *(2.1)*	9.97 *(2.1)*	5.77 *(2.0)*	5.20 *(2.4)*

have noticed the music and whether they like it (ranging from 1 "i do not like it at all" to 5 "i like it very much"). At the end of the questionnaire, other additional measures are introduced about whether they are on a diet (if yes, for how long), and their liking of the dragibus sweets (ranging from 1 "i do not like it at all" to 5 "i like it very much"). Finally, items for collecting their level of PA (i.e. MET scores) and their BMI are also included at the end of the questionnaire.

Results

Manipulation check and controls

ANOVAs yield no differences between participants' BMI (F (1, 144) = 0.20; $p > 0.10$) and MET scores (F (1, 144) = 0.80; $p > 0.10$) across the experimental conditions (Table III). Mean scores show a normal average BMI's score (M = 21.5; SD = 2.8; min = 16.3; max = 31.6) and a moderate level of activity (M = 3,227.1; SD = 2,376; min = 83; max = 12,090). In total, 10 per cent of the sample is actually on a diet (mostly to lose a few kilograms).

A significant effect is observed at the time of the session on the number of sweets consumed, F (3, 145) = 3.77; $p < 0.02$. Participants have eaten more sweets during the "end of the day" sessions (M = 7.9, SD = 2.1) than during the "morning" sessions (M = 1.9, SD = 0.7), the "lunch" sessions (M = 3.8, SD = 0.9) and the "afternoon" sessions (M = 3.2, SD = 0.6); post-hoc Tukey, $p < 0.02$. As expected, the intensity of the PA presented in the videos is judged more intense in the high intensity condition (M = 4.3, SD = 0.10) than in the low intensity condition (M = 2.7, SD = 0.10); F (1, 118) = 123.3; $p < 0.00001$.

Attitude toward the images of the video (images attitude index, α = 0.84) are not significantly different between the message conditions ($M_{Commercial\text{-}Low\ intensity}$ = 2.7 (SD = 0.12), $M_{Commercial\text{-}High\ intensity}$ = 3.5 (SD = 0.12), $M_{Health\text{-}Low\ intensity}$ = 3.2 (SD = 0.12), $M_{Health\text{-}High\ intensity}$ = 3.6 (SD = 0.12), and $M_{Control\ group}$ = 3.4; F (1, 144) = 2.56, $p > 0.10$), as well as the attitude toward the video itself ($M_{Commercial\text{-}Low\ intensity}$ = 2.2 (SD = 0.20), $M_{Commercial\text{-}High\ intensity}$ = 3.3 (SD = 0.20), $M_{Health\text{-}Low\ intensity}$ = 2.7 (SD = 0.20), $M_{Health\text{-}High\ intensity}$ = 3.6 (SD = 0.20), and $M_{Control\ group}$ = 2.6; F (1, 144) = 0.36, $p > 0.10$). On average, the images are judged quite adapted for a TV spot (M = 3.1; SD = 1.2) and no significant difference is observed between the different conditions, F (1, 144) = 2.76, $p > 0.10$). Participants have not declared they are differently concerned by the message whatever the conditions ($M_{Commercial\text{-}Low\ intensity}$ = 2.4 (SD = 0.21), $M_{Commercial\text{-}High\ intensity}$ = 2.5 (SD = 0.21), $M_{Health\text{-}Low\ intensity}$ = 2.8 (SD = 0.21), $M_{Health\text{-}High\ intensity}$ = 2.7 (SD = 0.22), and $M_{Control\ group}$ = 2 (SD = 0.20); F (1, 144) = 0.18, $p > 0.10$. All the participants have noticed the musical background. The music is moderately appreciated (M = 3.5; SD = 1.2), and no liking difference is observed according to the different conditions, F (1, 144) = 0.19, $p > 0.10$. No difference is observed about their perception of the video length, with an average mean of M = 109.6 s; (SD = 49.3), which is closed to the real timing of the videos (120 s).

Sweets intake

Participants' BMI score and MET score, time session, and Dragibus liking are introduced as covariates. ANCOVA reveals all the co-variables to be significant except for the BMI factor. A significant main effect is observed of the message variable on intake of sweets, F (1, 114) = 6; $p < 0.02$; η^2partial = 0.06, which indicates that participants exposed to the commercial message have eaten significantly more sweets (M = 4.5, SD = 0.5) than those exposed to the health message (M = 2.4, SD = 0.5), again supporting *H1*.

The one-way ANCOVA performed with the different conditions and the control group effect on the number of sweets consumed is significant, F (4, 141) = 2.6, $p < 0.05$, η^2partial = 0.07 (Figure 1). As expected, in comparison to the control group, a significantly higher amount of sweets is consumed when the participants are exposed to the commercial messages, whatever the intensity of the PA displayed (post-hocs, $p < 0.03$), supporting *H2a*. A non-significant difference is seen when the messages are said to be health messages (post-hocs, $p > 0.10$), supporting *H2b*.

No main effect of the factor of intensity or interaction effects is observed on the number of sweets consumed. However, to test more specifically hypothesis *H4* stating that a higher difference in the number of sweets consumed between the two types of messages would be observed when the physical intensity in the video is low, contrast analyzes are performed. A contrast analysis for specific hypotheses is often more appropriate than an omnibus test with several degrees of freedom (Brauer and McClelland, 2005; Rosenthal *et al.*, 2000). Contrast analyzes reveal that the difference between the commercial and the health message is significant only when the intensity of the PA of the video is low, F (1, 118) = 6.44, $p < 0.02$ (Figure 2), but not when the intensity is high, F (1, 118) = 1.77, $p > 0.10$.

Discussion

Study 2 confirms the main hypothesis (*H1*) of a higher sweets consumption when the video is labeled as a "commercial" message rather than a "health" message. Besides, the equal ingestion of sweets in comparison with a control group supports the assumption that labeling the video as a "health" message is a means to control for higher food intake when exposed to PA, supporting *H2b*. In contrast, exposure to a video labeled as a "commercial" message have led to a higher number of sweets consumed in comparison to a control group, regardless of the intensity of the PA displayed, supporting *H2a*. Finally, the intensity of the PA displayed had no main effect on the number

Table III Participants' means and standard deviations for BMI and metabolic equivalent according to the experimental conditions – Study 2

	Commercial message		Health message		
Measures	**Low intensity**	**High intensity**	**Low intensity**	**High intensity**	**Control group**
BMI	22.1 *(0.51)*	21.9 *(0.52)*	21.1 *(0.51)*	21 *(0.52)*	21.3*(0.52)*
MET	3,396.6 *(529.7)*	3,456.4 *(538)*	2,544.3 *(529.2)*	3,232.1 *(538)*	4,685 *(567.1)*

Figure 1 Number of sweets consumed according to the experimental messages or the control group – Study 2

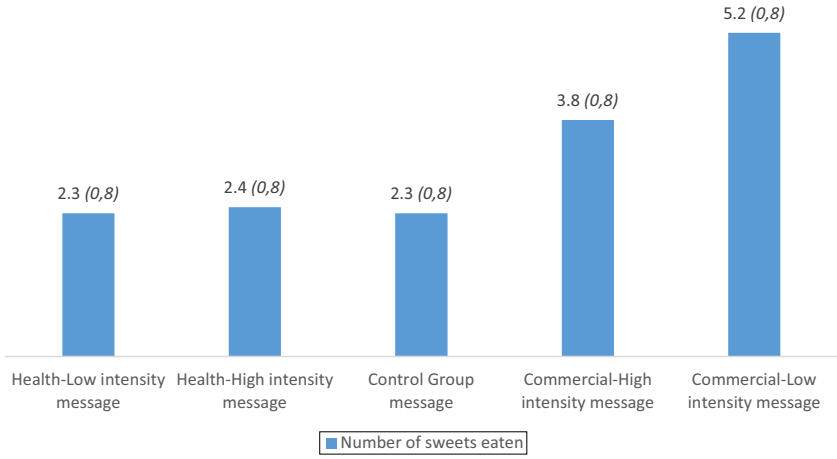
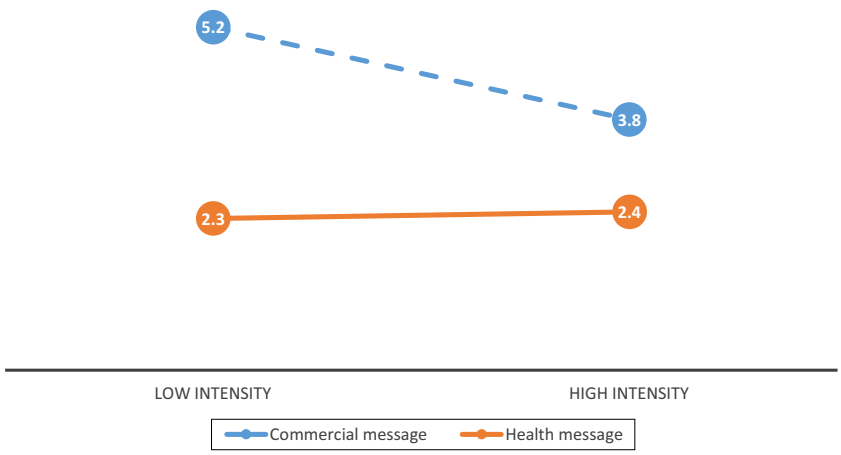


Figure 2 Number of sweets consumed according to the type of message and the intensity of the PA in the video – Study 2



of sweets consumed, not supporting *H3*, but has moderated the effect of the type of communication on food intake. The difference in food intake according to the type of communication, with a higher number of sweets ingested when exposed to the "commercial" message rather than to the "health" message, is significant when the PA is low, supporting *H4*. However, when the PA is intense, the expected, but smaller, food intake difference between the two messages is observed, but is not significant.

General discussion

The present research examines and confirms the main hypothesis that people exposed to a video message labeled as a "commercial message" eat more sweets than the participants exposed to the same video labeled as a "health message." A "commercial message" triggers more hedonic responses and impulsive behaviors (e.g. associated consumption behaviors), compared to a "health message," which triggers more deliberate behaviors and self-regulation motives. This result sheds light on the processes by which participants may regulate their behavior. Lay knowledge about the implicit intents of the messages is plausibly an important factor that guides people to infer the goal of the message (Wright, 2002).

Among the two moderators investigated as potentially influencing the phenomenon that is the level of personal relevance of the message (Study 1) and the intensity of the PA displayed (Study 2), the latter has moderated the impact of exposure to PA on food intake. The higher number of sweets ingested by participants exposed to the video labeled as a "commercial" message in comparison to the same video labeled as a "health" message is observed only when the PA displayed is low (i.e. walking, practicing soft gymnastics).

Theoretical contributions and practical implications

On the theoretical side, the present study presents an important contribution to the field of research on marketing communication and other research fields working on health behavioral issues such as health psychology, sport and nutrition sciences.

First, the two studies were a means to demonstrate how framing a communication containing PA differentially can

affect food consumption. Until now, literature has presented contrasting results about the influence of PA messages on food intake, either increasing or decreasing it (Albarracin *et al.*, 2009; Werle *et al.*, 2017; Van Kleef *et al.*, 2011). This research sheds light on the distinction between effects pertaining to the content of the message (i.e. PA) and the effects pertaining to the inferred goal of the communication. People generally know the intentions of communication and they may use this information, consciously or unconsciously, when processing the communication content. One question is about the participants' awareness of pursuing a self-regulated eating behavior following exposure to a message labeled as a "healthy" one. In other words, did they intentionally, consciously, control their sweets intake when the message goal activated self-regulation behaviors, making a conscious association between practicing sports to be in good health, and by extension eating better? In the present research, we tend to think that they were not aware of controlling their sweets consumption following health message exposure. During the debriefing, some of them told us that the video gave them the willingness or reminded them about the importance of doing sports, but no one mentioned that they had paid attention to eating fewer sweets or even more generally that they should control their food consumption. Some research has clearly demonstrated that when a goal is activated, consciously or not, it operates to drive a person's goal-relevant cognitive, affective and behavioral outputs (Bargh *et al.*, 2001). Unconscious goal effects on behavior do not require the individual to become aware of the goal pursued into the specific primed situation.

Second, the present research brings additional insight about the moderating role of the intensity of PA displays in the message. Findings tend to support that the significant increase in sweets consumed when exposed to a commercial message in comparison to a health message is observed only when the level of PA displayed is low. Literature has supported the idea that exposure to easy to perform sports increases chocolate consumption (Werle *et al.*, 2017). The present study brings additional insight by showing that the intensity of the PA displayed is also a critical factor. Both the goal of the communication and the individual's accessibility to the PA to which they are exposed are necessary conditions for the effect of PA exposure on food intake. Considering that mirror neuron activity is at the core of the PA exposure-food intake relationship process (Di Pellegrino *et al.*, 1992; Keysers and Gazzola, 2010), it makes sense that the more accessible the PA displayed (easy and/or low), the more the action is likely to be "mentally" performed and subsequently be followed by higher food intake. This issue is important and should be considered in future research. Indeed, the influence of the PA intensity on food intake is likely, for instance, to be moderated by the level of one's sports practice. A person regularly practicing intense sports may not judge the sports displayed in the intense PA as difficult, and thus, may compensate with higher food ingestion when exposed to a commercial message containing intense PA.

In terms of practical implications, the present research has implications for consumers, advertisers, marketers and public policies. Considering health promotion (Thompson *et al.*, 2011), the present findings are quite encouraging. Indeed, labeling the message as a health one was a means to control the food intake increase following PA exposure, whatever the intensity of the PA displays. Public Service Announcements encouraging the practice of a PA for being in good health should not be too worried about a backfire effect when promoting sports or being physically more active (e.g. walking, stepping rather than using a lift, etc.). Of course, caution must be taken that the message is well-identified as a healthy one. When it is not identified as a promotion for practicing PA to be in better health, self-regulation responses are unlikely to be observed. In addition, health professionals such as nutritionists should be aware of this relationship between exposure to PA and eating to inform their patients.

Commercial messages designed by the fitness and sports industries must consider the phenomenon with attention. Displaying intense PA in messages should be a better way to dampen the effect. However, these industries address their products to different targets who may be characterized by different levels of sports practice. Whether the effect of exposure to PA is activated when the PA displayed is mentally accessible, both low and high intensity physical activities displayed in a message are likely to influence a subsequent higher food intake among small and big sportspersons respectively. One solution would be to systematically link to the advertising message promoting the merits of a product the importance of participating in a sports activity to be healthy. This type of message would be better able to initiate controlled eating behaviors (i.e. eating less and better) and thereby reduce the deleterious effects of passive exposure to PA.

Media is an important real-life source of priming influences (Anderson and Bushman, 2002; Dunn and Yniguez, 1999; Halford *et al.*, 2004 , Harris *et al.*, 2009). Public health policies should consider warning the population about the perverse effect of the relationships between watching people performing physical activities and automatic food ingestion. This is true for commercial ads dedicated to the sport and leisure industry, as well as for contexts such as sports events broadcast in the media. The French government has policies like this in terms of warnings in commercial ads for food (e.g. "for your health, avoid snacking between meals"); similar warnings should be incorporated when people are exposed to PA messages or events. A message promoting the practice of a PA coupled with the necessity of eating in moderation to maintain good health could be a way to better prime self-regulated food behaviors.

Limitations and future research

On the whole, these results extend previously mixed findings on the priming effects of exercise on food intake (Albarracin *et al.*, 2009; Werle *et al.*, 2017; Werle *et al.*, 2011, Van Kleef *et al.*, 2011). Future tests should be run on what is specifically and mainly primed in people's minds when they are exposed to different goal-oriented persuasive messages and according to the message content. Besides, it would be interesting to explore the influence of PA on food consumption when no food is available at the time of exposure. Does a PA exposure trigger an active search for food? Then if yes, toward which kind of food choices is the search directed?

Among the limitations of this study, the convenient samples were composed mainly of young women with average BMI. These samples should be enlarged to include more men and people with restrictive habits, impulsive traits (Schüz *et al.*, 2015)

and high BMI. It would also be interesting to include other segmentation factors such as food preferences and sensitivity to rewards involved in addiction, excessive eating, and overweight issues (Davis *et al.*, 2004). It is even more critical to consider these factors in societies where rich, abundant and palatable food is readily available at low cost. It is well-known that some kinds of food are very attractive and trigger automatic reactions of consumption irrespective of any later negative consequences (Papies *et al.*, 2007). This observation is particularly true for food such as sweets. It would be of interest to replicate the present research using healthier food. Indeed, the kind of food, as well as the perception of food as either a meal or a snack has an influence on the amount of food consumed (Provencher *et al.*, 2009; Wansink *et al.*, 2010). People also differ on the basis of their health-related motive orientations, making them more or less sensitive to different kinds of health advertising messages (Geeroms *et al.*, 2008). This is particularly important because personal goals about a healthy lifestyle can affect self-regulation, and thus, increase the performance of health-promoting behaviors (Aarts, 2007).

Note

1 A small pre-test was performed on 31 participants [27 women; $M = 19.3$ ($SD = 1.8$)] with three independent groups exposed either to the low PA intensity video or the intense PA video or the control video (five-Likert scale measures) and showed no significant difference on the video's liking ($M_{Low\ PA} = 3.2$, $M_{Intense\ PA} = 3.5$, $M_{Control\ group} = 3.9$; $F(1, 28) = 1.8$, $p > 0.10$), the quality of the images for making a good TV spot ($M_{Low\ PA} = 2.5$, $M_{Intense\ PA} = 2.9$, $M_{Control\ group} = 3.1$; $F(1, 28) = 0.9$, $p > 0.10$) and the music liking ($M_{Low\ PA} = 2.9$, $M_{Intense\ PA} = 3.4$, $M_{Control\ group} = 3.8$; $F(1, 28) = 1.9$, $p > 0.10$). The difference in the intensity rating of the PA displayed between the two experimental videos was significant ($M_{Low\ PA} = 2.6$, $M_{Intense\ PA} = 4.2$; $F(1, 29) = 20.3$, $p < 0.0001$).

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