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Movie violence acutely affects food choices in young adults

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ABSTRACT

Background: Extensive research has been conducted to investigate the effects of media violence on attitudes, behaviors, and cardiovascular health; however, only few studies have examined its effect on appetite, eating behavior and food preferences. Little attention has been given to understand how movie genre manipulates the physiology and the eating behavior of individuals. The present study aimed at investigating the acute effect of violence content in movies on appetite perception, heart rate and blood pressure, along with food preferences and intake in young individuals.

Methods: Participants (n = 84) were randomly assigned to either watch a violent movie or a non-violent narrative movie. Measurements including anthropometry, heart rate, blood pressure and grip strength were taken and appetite as well as stress perception were assessed. Subjects were then provided with an individual snack tray containing various items to be consumed ad libitum.

Results: Post intervention, the experimental group (EG) had a higher consumption of fatty (t (82) = 2.28, p = 0.025, d = 1.52) and salty (t (82) = 2.61, p = 0.01, d = 0.71) food items compared to the control group (CG). Out of the 42 participants in the EG 62% consumed > 2 fatty items and 71.4% consumed > 2 salty food items. No significant difference in the consumption of sugary items was observed between the two groups.

Conclusion: Movie violence affects eating behavior and may promote weight gain.

1. Introduction

TV/movie watching has been associated with an increased risk for obesity (Chaput, Klingenberg, Astrup, & Sjodin, 2011; Sugiyama, Healy, Dunstan, Salmon, & Owen, 2008). Weight gain is potentially promoted due to both the sedentary aspect of watching TV/movies and the parallel increase in energy intake (snacking, eating alone, impulsive eating) (Chaput, Klingenberg, et al., 2011). However, other factors associated with movie content might also have a role in increasing weight gain.

A frequent feature of TV content, series and movies is *violence*. In developed countries, people of all age groups are exposed to a heavy dose of violent content through passive (TV programs, films) or interactive media (video games, internet) (Anderson et al., 2010; *Media and the American child*, 2007).

There has been an increased interest in investigating the effect of media violence in general, and TV/movie violence in particular, on psychological, behavioral and physiological health over the past six decades (Anderson et al., 2003). Exposure to violence has been shown to have effects at the psychological level (increased aggressive attitude, behaviors and beliefs) and has been associated with developing addictive behaviors in children and adults (Anderson et al., 2003; Anderson et al., 2010; Johnson, Cohen, Smailes, Kasen, & Brook, 2002). Moreover, it was shown that violence in media may impact the body acutely at a somatic level. In fact, media violence increases heart rate, blood pressure and affects general cardiovascular health (Anderson & Bushman, 2001; Hasan, Begue, & Bushman, 2013; Mrug, Madan, Cook, & Wright, 2015). Hasan et al. (2013) reported that violent-game players had lower cardiac coherence and higher aggression levels compared to non-violent games players. Similarly, work by Siervo, Sabatini, Fewtrell, and Wells (2013) revealed that playing violent video-games increased diastolic blood pressure compared to watching television for 1 h in normal and overweight men (Siervo, Gan, Fewtrell, Cortina-Borja, & Wells, 2018).

While extensive work has been done on the effects of media violence on attitudes, behaviors, and cardiovascular health, only few studies have investigated its effect on appetite, eating behavior and food preferences. We have previously reported that while hunger and appetite are not directly impacted by the different genre of movies in a random population, horror/violent movies were associated with a decreased preference for sweet foods (Mattar, Zeeni, & Bassil, 2015). Indeed, it is established that food intake is affected by emotions, stress and

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impulsivity (Habhab, Sheldon, & Loeb, 2009; Punzi, 2016; Siervo et al., 2013; Ulrich-Lai, Fulton, Wilson, Petrovich, & Rinaman, 2015). Older work by Cools, Schotte, and McNally (1992) showed that emotion arousal from horror and comedy movies increased food intake and had a disinhibiting effect on restrained eating compared to a neutral movie in female restrained eaters. Two recent randomized trials concluded that playing video games was associated with increased markers of stress as well as appetite changes compared to watching TV (Mario, Hannah, Jonathan, & Jose, 2014; Siervo et al., 2013). In the first study, preference for eating sweets was found to be higher in subjects playing violent games compared to those playing non-violent games (Siervo et al., 2013). In the second study, which was conducted in overweight men, participants playing violent games subsequently consumed more food during a test-meal compared to those watching regular TV or playing non-violent games (Mario et al., 2014). It is important to note that these studies addressed 'participatory games'.

While there has been extensive research on the impact of violence exposure, no study has investigated the effects of passive exposure to media violence, through watching films, on appetite control and food preference. To our knowledge, little attention has been given to understand how movie genre manipulates the physiology and the eating behavior of individuals acutely.

The present study therefore aimed at investigating the acute effect of violence content in movies on appetite perception, heart rate and blood pressure, along with food preferences and intake in young individuals.

2. Methods

2.1. Design

This study followed a 2-arm randomized assignment of participants to an experimental or control group. The former watched a violent movie whereas the latter viewed a non-violent narrative movie (romantic comedy). Eligible subjects were asked to fast and to avoid drinking caffeinated beverages for 8 h prior to their visit, which was in the morning (at 9 or 10 am). Upon arrival, a standardized snack was provided to the participants. Baseline measurements included anthropometric measurements, Heart Rate (HR) and Blood Pressure (BP), in addition to grip strength. Based on previous literature, we hypothesized that hand grip is an indicator of acute stress exposure; handgrip gets stronger when stress increases, as cortisol is secreted and glucose is released at the level of the muscles (Sunram-Lea, Owen-Lynch, Robinson, Jones, & Hu, 2012). In fact, according to Crewther et al. cortisol levels and release predict the hand grip strength (Crewther, Thomas, Stewart-Williams, Kilduff, & Cook, 2017; Ribeiro et al., 2016). Appetite and stress perception were assessed. Post measurements included HR and BP, grip strength, appetite and stress perception. The emotions elicited through the movie were also surveyed. Finally, subjects were provided with a snack tray containing various items to be consumed ad libitum to additionally assess food type preference and choice based on 3 clusters: salty, sugary, or fatty foods.

2.2. Participants

A convenient sample of participants was recruited on volunteer basis over a period of 4 months. Participants were selected if they were between the ages of 20 and 30 years, non-smokers, and had no history of hypertension, diabetes, and CVD. In addition, volunteers on special diets, having any food allergy or taking any medication that may interfere with the study outcomes (e.g. antihypertensive drugs, glucose regulating drugs, etc.) were excluded. This study was approved by the Institutional Review Board (IRB) at the Lebanese American University, Lebanon (LAU.SOAS.LM1). Prior to conducting the experiment, written informed consents were obtained from all participants. However, the main purpose of the study was concealed to ensure that natural responses are elicited. At the end of the experiment, each participant was immediately debriefed about the purpose of the study and its design.

2.3. Measurements

2.3.1. Anthropometric measurements

Height (cm) and weight (kg) were measured using the Detecto beam scale and stadiometer (Detecto, Webb City, USA). Waist circumference (cm) was measured using a non-elastic measuring tape. Body mass index (BMI) was calculated by dividing the weight (kg) over the height squared (m^2).

2.3.2. Physiological parameters

Heart rate and BP were measured using the Digital Blood Pressure Monitor K2-1702 (Alfresa, Tokyo, Japan). Grip strength was assessed using the Jamar Plus Digital Hand Dynamometer (Patterson Medical, Warrenville, USA). Grip strength measurement included the assessment of each arm twice.

2.3.3. Emotional perceptions

Hunger, appetite, food preference and stress perception were assessed using a standardized and validated Visual Analogue Scale (VAS) (Monk, 1989; Stubbs et al., 2000). The VAS has been used extensively in similar studies (Chaput, Visby, et al., 2011; Siervo et al., 2018) and has been validated for repeat use within-participant under controlled circumstances (Madsen et al., 1995). The VAS consists of placing a vertical line on a 10 cm horizontal line in between two opposing statements defined as 'very little' to 'very much'. Afterwards, the scales were measured using digital calipers to the nearest 0.01 cm. Through this it records subjective feelings of anxiety and stress, depression, sleepiness, tiredness, hunger, satiety, food preferences and desire to eat. Participants completed a post-film questionnaire to assess subjective emotional responses to the movie. The post-film questionnaire is a 9-point scale ranging from 0 (not at all) to 8 (extremely) and assesses 18 specific emotions including anxiety and fear (Rottenberg, Ray, & Gross, 2007). The *intensity* score is computed based on the anxiety and fear scales and is used to assess if the movie was efficacious on participants.

2.3.4. Food intake

Food items were presented on an individual tray for each participant with no strict instructions but rather perceived as "offered". The main purpose of the tray was concealed to ensure that natural responses are elicited. Afterward the participant was left unobserved to feel comfortable to consume whatever he/she preferred. The tray included a handful of popcorn 50 g (Jolly Time Pop Corn), chips 50 g (Lays), tortilla chips 28 g (Doritos, Nacho cheese flavor), cheddar cheese dip (Doritos), chocolate bar 47 g (Galaxy), biscuit with chocolate 100 g (Biskrem, Ulker), fruit flavored candies 2 oz (Skittles), a small apple, cereal bar 42 g (Natural Valley, Oats'n Honey), orange juice 250 ml (Tropicana Co.), a soda can 240 ml (Pepsi Co.) and a 500 ml bottle of plane water. Food items were clustered into 3 groups: sugary, salty or fatty based on their main taste and composition. There was no time limit for the participants to consume the foods. Food items that were consumed partially or totally were counted as a "consumed item" following a dichotomous counting of 1 (consumed) or 0 (not consumed).

2.4. Movie selection

One movie was selected for each group based on movie genre (horror/violent vs. romantic comedy/narrative), length (same duration), and Internet Movie Database (IMDb) score (ranging between 6.2 and 7.6). The experimental group included the horror movie "Mirrors" (1 h 52 min). The control group included the romantic comedy movie "Love & Other Drugs" (1 h 53 min).

2.5. Procedure

Eligible participants were invited individually for movie screening and measurements to the nearest LAU campus (Beirut or Byblos, Lebanon). Female participants underwent the experiment on days outside their menstrual cycle ± 4 days. Following baseline measurements and standardized snack consumption (0.3 L of water and a slice of white bread with thyme), participants were randomly assigned to experimental vs. control group based on the result of a draw from a jar; the jar contained 40 small papers divided equally between the two movie genre and rolled similarly, participant would pick one paper. The recruitment was done by group of 3 or 4 participants at a time. Once the draw is done, the participants watch the same movie. Each participant then started watching the selected movie on a 40 inches' screen and DVD player in a comfortable sofa and a darkened room. Participants were furthermore asked to silence their cell phones and refrain from using them. To minimize observer effect, the investigators were absent from the room. Immediately after movie screening, HR, BP and grip strength were measured. The post-film questionnaire and the VAS were then administered. Subsequently, the researchers offered the participant a snack tray consisting of the aforementioned items.

2.6. Statistical analyses

Analysis was performed using STATA v11. Anthropometric measurements (weight, height, BMI and WC) and physiological parameters (SBP, DBP and HR) were collected from all 84 participants. Hand grip strength was collected from 76 participants A missing-values analysis was conducted and revealed that the hand-grip strength variable was the only variable that had 9.5% of missing data. Little's MCAR test indicated that the data were missing at random, $\chi^2 = 221.929$, $p = 0.736$.

Descriptive analysis was used to summarize the study variables and to check for out of range values. Categorical variables were described using frequencies and percentages, while means and standard deviations were used to represent continuous variables. Chi square test was performed to check for gender differences. Physiological parameters were collected at baseline and post intervention for both control and experimental groups. VAS Questionnaire was administered pre and post intervention for both groups as well. Mean scores on the total, major subscales (nervousness, sadness, exhaustion and appetite) and specific appetite clusters (sweet, salty, savory and fatty) were compared within groups at baseline and post intervention; and between groups. Post movie questionnaire was collected post intervention for both groups. Paired *t*-tests were used to compare the mean scores within groups for physiological parameters and VAS total and subscales. Independent t-tests were used to compare the mean scores between groups for VAS total and subscales and post movie questionnaire. Two-tailed *p*-values are reported.

3. Results

3.1. Participants' characteristics

Eighty-four participants (F = 36; M = 48) were finally enrolled; 42 in the experimental group (EG) and 42 in the control group (CG). No differences in the number of males or females between the control and experimental groups ($p = 0.66$), with 23 and 25 males and 19 and 17 females in the CG and EG respectively. The mean age of the subjects was 21.75 (SD = 2.01) and the mean BMI was 23.34 (SD = 2.78). Characteristics of the study participants are shown in Table 1.

Table 1
Demographic characteristics of study participants.

	CG (N = 42)	EG (N = 42)	*p*-Value
Age (years)	21.11 (1.11)	22.53 (2.53)	0.0025*
Gender			
Male	23 (55%)	25 (60%)	0.66
Female	19 (45%)	17 (40%)	
Weight (kg)	69.19 (16.84)	69.85 (16.88)	0.86
Height (cm)	171 (11.21)	171 (9.01)	0.98
BMI (kg/m^2)	23.29 (3.87)	23.51 (3.93)	0.79
Waist circumference (cm)	81.61 (12.06)	82.34 (12.71)	0.78

Data is presented as mean ± SD for continuous variables and N (%) for categorical variables.
CG = control group, EG = experimental group.
* $p < 0.05$.

3.2. Emotional responses to the movies

The mean *intensity* score, measured using the post-movie questionnaire, was significantly higher in the experimental group compared to control group (t (82) = 4.94, $p \leq 0.001$, *difference* = 4.21).

3.3. Physiological parameters

There were no significant differences between the 2 groups at baseline or post-movie for any of the physiological parameters (HR, hand-grip, BP).

The control group had a significant decrease in HR post-movie (HR baseline = 82.7; HR post-movie = 77.2; $p = 0.001$) but did not reach a difference with the experimental group.

3.4. Appetite perception, food preference and stress perception

At baseline group assignment had no significant effect on VAS score for nervousness, exhaustion, sadness, hunger or appetite (overall and subscales); Post intervention mean scores on the nervousness (t (41) = 4.26, $p = 0.0001$, *difference* = 6.43), exhaustion subscales (t (41) = 4.04, $p = 0.0002$, *difference* = 2.84) and sadness (t (41) = 6.68, $p \leq 0.0001$, *difference* = 5.35) were *higher* compared to baseline scores for the participants in the EG. No significant differences were observed in the hunger, appetite or specific appetite clusters (sweet, salty, savory or fatty) compared to baseline scores for that EG. As for CG participants, no significant changes were noted in any of the nervousness, exhaustion, hunger or appetite subscales pre and post-movie.

Moreover, when compared to CG, participants in the EG had higher mean scores on the VAS nervousness (t (82) = 5.09, $p \leq 0.0001$, *difference* = 8.14), exhaustion (t (82) = 3.48, $p = 0.0008$, *difference* = 3.31) and sadness (t (82) = 2.18, $p = 0.0032$, *difference* = 3.12).

3.5. Food choices and preferences post-movie

Post movie, the EG had a higher consumption of fatty (t (82) = 2.28, $p = 0.025$, *difference* = 1.52) and salty (t (82) = 2.61, $p = 0.01$, *difference* = 0.71) food items compared to the CG. Out of the 42 participants in the EG 62% consumed > 2 fatty items and 71.4% consumed > 2 salty food items. No significant difference in the consumption of sugary items was observed between the two groups. The total number of food items consumed was higher among the EG compared to CG (t (82) = 2.28, $p = 0.025$, *difference* = 1.52); with a consumption on average of 6.45 (SD = 3.37) items among EG compared to 4.93(SD = 2.71) among CG (Fig. 1).

The mean consumption scores of fatty items and salty items were 1.8 (SD = 1.24) and 2.3 (SD = 1.26) among EG versus 1.3 (SD = 1.22) and 1.6 (SD = 1.25) among CG.

3.6. Age differences

In order to control for the difference in age among the two groups, a series of linear regression analysis were conducted. Results revealed

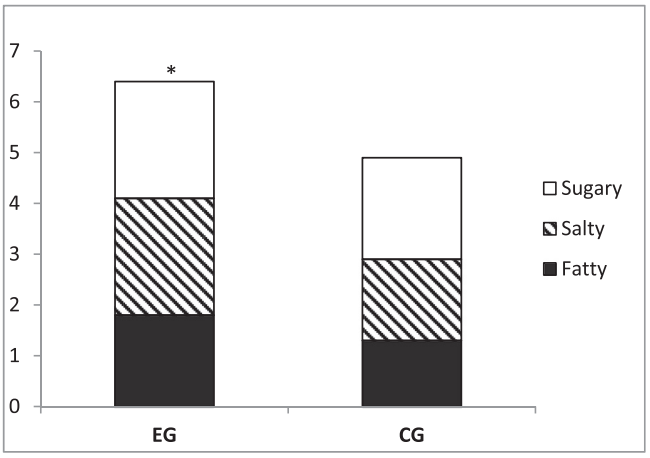

Fig. 1. Mean item-consumption for the experimental and the control group. *Group $p < 0.05$.

that participants in the experimental group had significantly higher scores on nervousness ($\beta = 8.75$, $p < 0.0001$) and exhaustion ($\beta = 3.52$, $p = 0.001$) subscales post intervention compared to those in the control group after correcting for age. However, scores on sadness subscales were significantly lower among the experimental group participants ($\beta = 2.79$, $p = 0.025$) compared to those in the control group at baseline after correcting for age. The significant association was lost post-intervention after correcting for age ($\beta = 2.66$, $p = 0.091$). All other obtained results were in line with the independent *t*-test results (Table 2).

4. Discussion

To our knowledge, the present study is the first to investigate the acute effect of violent content in movies on food intake, food choices and appetite.

Our results reported that violent movies had an acute stressful and intense effect on the spectators, even though watching a movie is a passive activity. Participants in the experimental group scored higher on the nervousness and exhaustion subscales compared to baseline scores, whereas controls did not show any increase in these scores. Similarly, recent studies investigating the effects of violent video-game playing (participatory activity) showed increased stress response compared to watching non-violent TV in overweight (Siervo et al., 2018) and normal weight men (Siervo et al., 2013). Consistently, the intensity scores of the post-movie questionnaire were significantly higher in our experimental group. We have previously reported similar results in a random sample of 447 individuals coming out from different types of movies in theaters; whereby people who watched a horror/violent movie felt significantly more stressed, nervous and anxious; conversely, individuals who watched romance felt sleepier and less tensed (Mattar et al., 2015).

It is worthy to note that this increase in perceived stress measured by the VAS failed to significantly increase clinical parameters such as heart rate, blood pressure or handgrip strength which could increase due to the release of cortisol under stress (Crewther et al., 2017; Ribeiro et al., 2016; Sunram-Lea et al., 2012).

Interestingly, post-intervention, the experimental group participants did not report having an increased appetite or a clear preference toward consuming salty and fatty items, although they consumed more high-density fatty and salty food items compared to the control group. Stressful conditions have been correlated with increased intake and preference toward high-energy dense snacks foods (O'Connor & O'Connor, 2004). It was also shown that daily chronic life stress could also increase preference for energy- and nutrient-dense foods (Torres & Nowson, 2007) or what we call *comfort* food.

An explanation can be that palatable food is known to dampen stress responses (Adam & Epel, 2007). Undeniably, there appears to be a link between palatable *comfort* food and positive emotional feelings (sense of security, well-being), and an increased consumption of sweet and fatty foods during stress was actually found to reduce the stress response (Dallman et al., 2003; Epel, Lapidus, McEwen, & Brownell, 2001). It was suggested that the increase in glucocorticoid levels associated with stress leads to a drive toward pleasurable activities such as ingesting comfort foods and causing an indirect increase in abdominal fat depots (Dallman et al., 2003). Therefore, subjects who have been exposed to a violent movie may be driven toward fatty and salty items in order to dampen the stress that was triggered by the movie.

On the other hand, some studies have demonstrated that the increased auditory stimulation, tempo and rhythm of music which are characteristic of violent movies might have an effect on food choice and intake, by making the spectator choose less healthy options (Privitera, Diaz, & Haas, 2014).

The strengths of this study stem in its novelty; since there is little evidence of the effect of watching violence on appetite, eating behavior and food choices. Furthermore, the present work replicates real life situations in a young mixed gender population; it measures real food choice and preferences by quantifying intake from a known ad libidum

Table 2
Baseline and post intervention physiological and VAS measurements between study groups.

	Baseline				Post movie			
	CG	EG	t	*p*-Value	CG	EG	t	*p*-Value
Physiological parameters								
SBP (mm Hg)	119.3 (10.94)	116.1 (10.60)	1.35	0.18	115.3 (9.76)	117.5 (11.33)	0.96	0.34
DBP (mm Hg)	73.67 (10.54)	69.90 (9.56)	1.71	0.09	72.12 (9.03)	68.90 (9.87)	1.56	0.12
Heart rate (bpm)	78.52 (12.20)	82.71 (16.22)	1.34	0.18	75.16 (11.06)	77.19 (15.15)	0.69	0.48
Grip strength	32.75 (12.72)	35.28 (14.28)	0.82	0.42	33.67 (12.64)	35.39 (13.78)	0.56	0.57
Emotional perceptions: Visual Scale Analogue								
Nervousness	1.59 (1.12)	3.05 (7.43)	0.91	0.36	1.34 (6.98)	9.48 (7.67)	5.09	< 0.0001*
Sadness	−0.15 (5.77)	−2.82 (4.39)	−2.38	0.0194*	−0.59 (5.95)	2.52 (7.10)	2.17	0.03*
Exhaustion	4.36 (4.18)	3.22 (4.69)	−1.17	0.24	2.75 (4.48)	6.06 (4.23)	3.47	0.0008*
Appetite	9.30 (4.19)	10.03 (3.59)	0.85	0.39	9.77 (3.09)	9.91 (4.26)	0.17	0.85
Sweet preference	5.17 (3.32)	5.35 (3.32)	0.25	0.80	5.09 (3.38)	5.27 (3.29)	0.24	0.81
Salty preference	5.22 (3.26)	6.09 (2.95)	1.28	0.20	5.03 (3.31)	6.15 (2.91)	1.64	0.11
Savory preference	4.42 (2.96)	4.89 (2.72)	0.76	0.44	4.53 (3.18)	5.09 (2.86)	0.85	0.39
Fatty preference	4.59 (3.23)	4.76 (3.45)	0.23	0.81	4.88 (3.27)	4.93 (3.68)	0.06	0.94

Note. CG = control group, EG = experimental group.
* $p < 0.05$.

meal along with measures of perception of appetite and preferences of food. A possible limitation of the study is that participants could not eat during the movie but rather at the end of it. Food intolerances, other than food allergies, could have been overlooked at for exclusion criteria. Also, a bigger sample size is needed in order to confirm our hypothesis.

5. Conclusion

The present study sheds the light on the possible effects of movie violence on eating behavior, highlighting a predominant increase in energy intake. This result implies that weight gain and obesity associated with screen time may not only be attributed to the fact that it is a sedentary activity but also to an associated increase in energy-dense snacking.

Addressing this issue and its implication in children is a must. This could be done through public health interventions that tackle movie content.

Future research is needed where biomarkers of stress activation and appetite control are measured in order to elucidate the underlying mechanisms. Also, repetitive screening of violent movies might have different effects given the possible adaptation mechanism.

Ethics approval and consent to participate

The Lebanese American University IRB (International Review Board) reviewed and approved the study. Each participant received a full disclosure of the nature of the study, its risks and benefits, was reassured of the confidentiality and anonymity of the data and was given the opportunity to ask questions. A written informed consent was signed by each participant willing to participate in the study.

Consent for publication

Not applicable.

Availability of data and material

Please contact author for data requests.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

LM has designed the study, written the research protocol, conducted statistical analysis, interpreted the results, and participated in writing the draft of the manuscript as well as reviewing and approving the final manuscript.

NF has participated in the literature searches, conducted the survey, entered the data and generated the preliminary results.

JAK conducted statistical analysis, generated and interpreted the results.

ZN has participated in data analysis and results interpretation, contributed in editing the first draft of the manuscript as well as reviewing and approving the final manuscript.

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