

Is brand visibility on snacks packages affecting their consumption in children? Results from an experimental *ad-libitum* study

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SUMMARY: The aims of the study were to assess the effects of the brand when snacking in children 6-11 years old and to evaluate the effect of different levels of brand awareness on children's intake. A 3x2 factorial design was adopted, and 96 children were randomized based on their brand awareness scores, assessed using the IBAI instrument and the study was conducted over two experimental sessions. First, 11 snacks were presented to the half of children laying on their own branded packages, whilst to the other half unbranded. In a second afternoon break, on a different day, the condition of branded/unbranded was crossed-over. Children were randomized in three groups based on combinations of concomitant TV and advertising exposure. Caloric intake (Kcal) of snacks eaten during sessions was taken as the main study outcome. No significant differences in energy intake were recorded according to brand visibility, both in children with high and low brand awareness. Exposure to TV and advertising showed no significant association with energy intake in the different groups and with the likelihood of being a high consumer. The present study suggested that brand visibility did not promote a higher caloric intake in 6-11 years old children during a snacking occasion.

Key words: Food brand, snacking, advertising, *ad libitum*, brand awareness, caloric intake.

RESUMEN. ¿La visibilidad de la marca en el empaque afecta el consumo en los niños? **Resultados de un estudio experimental *ad libitum*.** Los objetivos del estudio fueron el evaluar los efectos de las marcas comerciales durante una merienda en niños de entre 6 y 11 años de edad, así como analizar el efecto de diferentes niveles de conciencia de marca en el consumo de los niños. Se utilizó un diseño factorial 3x2, y se asignó al azar a 96 niños según sus puntuaciones de conciencia de marca, que fueron evaluados mediante el instrumento IBAI. El estudio se realizó en dos sesiones experimentales. En primer lugar, se presentaron 11 bocadillos (alimentos), a la mitad de los niños colocando en sus propios paquetes de marca, mientras que a la otra mitad sin marca. En un segundo recreo de la tarde, otro día, se realizó un cruce en la condición de bocadillos de marca y sin marca. Los niños fueron asignados al azar en tres grupos, según combinaciones concomitantes de exposición a la televisión y a pautas publicitarias. La ingesta calórica (Kcal) de bocadillos consumidos durante las sesiones se adoptó como principal resultado del estudio. No se registraron diferencias significativas en el consumo de energía dependiendo de la visibilidad de la marca, ni en los niños con un alto o bajo reconocimiento de marcas. La exposición a la televisión y a la publicidad no mostró una asociación significativa con el consumo de energía en los diferentes grupos y ni con la probabilidad de ser un gran consumidor. El presente estudio sugiere que la visibilidad de las marcas no promueve una mayor ingesta calórica en niños de entre 6 y 11 años de edad en el contexto de una merienda.

Palabras clave: Marca de alimentos, refrigerio- colación, publicidad, a gusto, conocimiento de la marca, ingesta calórica.

INTRODUCTION

The growing prevalence of overweight and obesity in children has gathered an extensive interest from the scientific community (1),

shifting from an initial analysis dedicated to assess the present situation and its outcomes toward a broader research targeting potential risk factors involved in its development and

maintenance. The increase in childhood and adolescent obesity is leading to adverse health outcomes in the short and in the long term (2, 3), since it is deleterious to individual health, and it also results in a rising cost for the public sector.

The multifactorial network characterizing obesity determinants has frequently been mentioned, in order to broaden research towards a complex scenario taking into account mutual influences and relationships (4, 5). Each node of this net is characterized by different factors, that are modified, switched, and triggered by several macro structures, like genetics, behavior, built and social environment.

Among various factors identified as possible causes for the increase of children's obesity, television viewing and advertising aimed at children are among the most important factors that have been linked to a reduction in physical activity and an overconsumption of food high in fat and sugar (6, 7).

The mechanism is etiologically grounded on the lower caloric expenditure associated with TV viewing and the increased caloric intake due to TV-generated distraction and snack advertisements. In addition, recent studies have pointed out that, especially in overweight and obese children, preference for high carbohydrate and high fat foods is enhanced in children who are exposed to the greatest amounts of televisual media (8). Experimental studies in adults suggest that focusing attention on watching TV or listening to music while eating may disrupt the ability to regulate energy intake and promote overeating (9, 10). Similar associations were found in children, showing a positive association between TV viewing and childhood obesity (11, 12), but they failed to describe the mechanisms underlying these results. Costa showed the inverse association between screen time and daily consumption of fruits, concluding that the number of television in a household is positively related to BMI in children and adolescents (13).

Literature provides such heterogeneous results referring to the impact of food advertising on children's food consumption (14). The effect of advertising and its interaction with brand visibility during afternoon snack time has not been yet jointly investigated. Indeed, afternoon snacking has not been very much studied, and its effects, both in terms of nutrient composition and caloric intake, on dinner eating habits or its impact on after-school physical activity are still not entirely known (15).

The primary aim of the present study was to assess the effect of having brands displayed in food packaging on children's eating behavior during an afternoon snack time. The secondary objective is to evaluate the effect of different levels of brand awareness on children's intake. By design, TV viewing and brand advertising (displayed both on food package and on TV commercials) were taken into account as potentially intervening factors and balanced during randomization.

MATERIALS AND METHODS

Design

The present study was a randomized, 3x2 factorial experimental study. For logistic purposes, the study was organized in three steps: assessment of brand awareness (Step 0), evaluation of brand visibility on children's caloric intake (Step 1), repetition of Step 1 by crossing over the condition of branded/unbranded visibility (Step 2).

In Step 0 children were selected by means of the score reported from a modified version of the original IBAI questionnaire (16), assessing brand awareness. The total sample was then divided into two groups, one included high brand awareness (characterized by a total scoring ≥ 40 points) subjects, and the other, a low brand awareness (< 40 points) ones. Furthermore, each group was further assigned to one of three

different conditions of TV exposure (No TV, TV, TV + advertising), resulting in 6 factorial combinations. In each category, the resulting 12 children were stratified for brand awareness, age, and gender (Table 1) and finally randomized to brand visibility. In summary, the experimental study developed in Step 1 had a 2x3 (Brand Visibility x TV and advertising exposure) full factorial design, blocked by age (two groups 6-8 and 9-11 years old), by gender (male and female) and by brand awareness. Specifically, the first factor was TV exposure, organized in 3 different levels: no TV exposure, exposure to cartoons, and exposure to cartoons and advertisements. The second factor was the presence of the brand on the snacks given to children, and was organized in two levels: presence of the brand (branded), absence of the brand (unbranded).

Step 2 was carried out equally to Step 1, but inverting the brand level in the two groups (branded snack were given to the subsample that had received an unbranded snack in Step 1, and vice versa).

Participants

Ninety-six children between 6 and 11 years of age were selected to have high and low level of brand awareness. Children were recruited as equally distributed by gender and age: forty-eight 6-8-year-olds (24 female) and forty-eight 9-11-year-olds (24 female). Children

with cognitive disorders or metabolic diseases or allergies to the products offered during the experimental session were excluded. Parent informed consent was obtained for all children prior to each child's participation in the study. Children's participation followed the guidelines and ethics issued by APA (17). Parents were asked not to provide snacks to children in the hours before the experimental sessions.

Sample size

The sample size of 96 children was computed with reference to an alpha equal to 0.05 and a power of 0.90, which aimed at detecting at least a difference of 20 Kcal of caloric intake (assuming an equal standard deviation in the two groups of approximately 30 Kcal) between the two groups of Brand Visibility in each of the 8 randomization cells (Age x Gender x Brand Awareness).

Experimental procedure

The preliminary phase of this study (Step 0) involved sample recruitment and stratification. The sample consisted of children between 6-11 years (children attending primary school).

Children were selected on the basis of their level of brand awareness assessed by means of the IBAI (Italian Brand Awareness Instrument (16); a logo-matching exercise, consisting of 30 pictures representative of food brand logos) and they were equally divided into high and low brand awareness groups.

The experiment was characterized by two experimental sessions separated by a 2-week period (Step 1 and Step 2), in which parents were asked to bring their children to the laboratory during two afternoon breaks. The project flow is presented in Figure 1.

In Step 1, 11 snacks were placed on a tray, laying on their own branded packages, for half of the sample, whilst the other half of the children received a neutral tray (unbranded).

After 2 weeks period, Step 2 was performed and the condition of branded/unbranded was

TABLE 1. Sample stratification according to age, gender and brand awareness. Mean Brand Awareness scores, with SD in brackets.

Gender	Age	n	Brand awareness score High	n	Brand awareness score Low
Male	6-8 ys	12	46.67 (2.81)	12	28.17 (5.25)
	9-11 ys	12	47.00 (3.10)	12	29.33 (5.42)
Female	6-8 ys	12	46.17 (3.16)	12	26.58 (8.74)
	9-11 ys	12	45.83 (3.59)	12	27.33 (6.34)

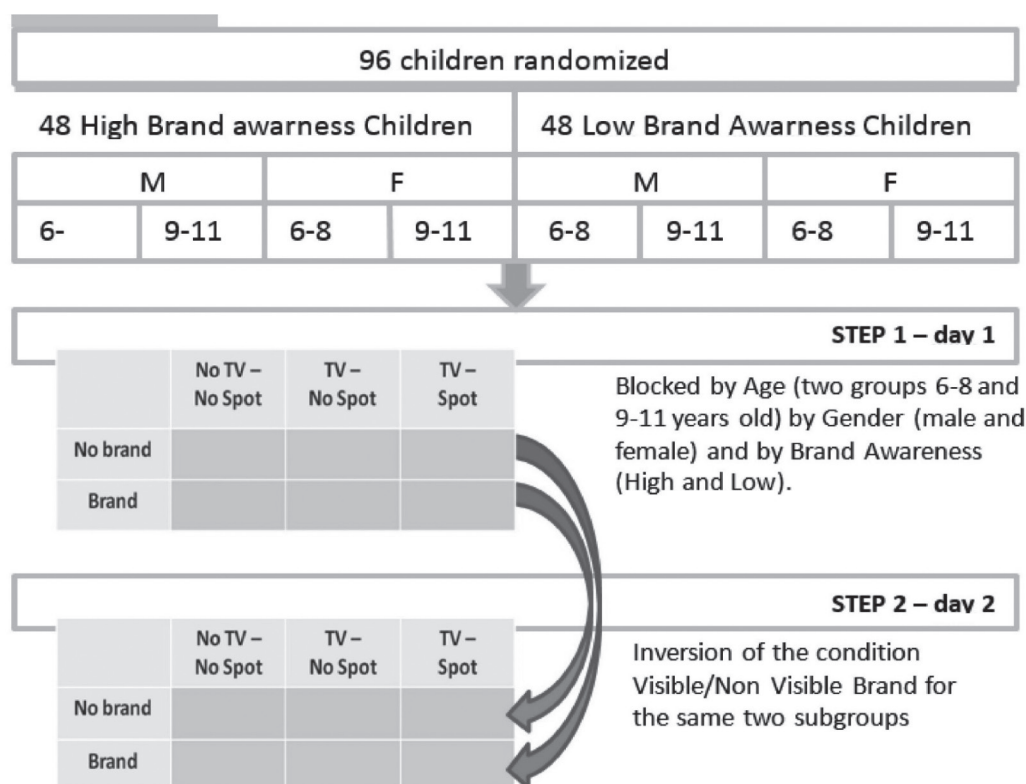


FIGURE 1. Project flow.

inverted for the same two subgroups of the sample. The snacks utilized in the experiment were Kinder Frutti®, Ferrero Brioss Albicocca®, Kinder Brioss Latte®, Kinder Delice®, Mulino Bianco Flauti Latte®, Mulino Bianco Flauti Albicocca®, Mulino Bianco Pan Goccioli®, Mulino Bianco Saccottino Albicocca®, Mulino Bianco Pan di Stelle®, Kinder Yogo Brioss®, Mulino Bianco Plum Cake®. Snacks included: cocoa biscuits (Mulino Bianco Pan di Stelle®); individually packaged soft pastries with apricot jam (Kinder Frutti®, Ferrero Brioss Albicocca®, Mulino Bianco Flauti Albicocca®, Mulino Bianco Saccottino Albicocca®, Kinder Yogo Brioss®), milk cream (Kinder Brioss Latte®, Mulino Bianco Flauti Latte®) and chocolate chips (Mulino Bianco Pan Goccioli®); individually packaged soft sponge with cocoa cream topping and filled with milk cream (Kinder Delice®); individually packaged mini-plum cakes made with yogurt (Mulino Bianco

Plum Cake®). Children's preferences towards these snacks were not investigated.

The two groups of children characterized by different brand awareness (high and low brand awareness) were randomized into 3 groups based on TV and advertising exposure: No TV, TV, TV and advertising. Within the "TV" subgroup, younger children watched a 16 min. episode of Disney® Lion King, while the older ones watched a 16 min. episode of Marvel® Spiderman. The advertising utilized in the third subgroup was embedded within the movies and consisted in 7 spots lasting for 3 minutes, referred to the products that children had on the tray they were facing.

All children were asked to eat *ad libitum* and to choose the snacks they preferred, being given 16 minutes from their first bite.

All the snacks were weighed with a high-precision balance before and after each session,

in order to quantify the amount of snack not eaten, therefore estimating energy intake of each child.

Measures

Socio-Demographic variables

Before the starting of the experimental session, parents were interviewed by the investigators in order to assess demographic parameters, children's health status, behaviors, frequency of food consumption, food habits, physical activity, daily lifestyle (sleep, TV viewing, after-school care, etc.).

IBAI questionnaire

Food images represented in the 30 flash-cards of the IBAI were shown to the children (16), interviewing them on food images' brand and product names and subsequently on the correct matching of each logo with the right food, between four choices of foods.

At the end, the interviewer asked the child on the specific name of the product. Brand Awareness Scores (IBAI-score) could range from a minimum of 0 to a maximum of 90, with a cut-off set at 40 points which was used to define the two groups: low brand awareness children (<40) and high brand awareness (≥ 40) (16).

Snacks weighing

At the beginning of the study, every snack was assigned with a specific code and was weighed in order to record these data in the software used for the study. At the end of every session, each snack the child had had was weighed once again in order to calculate the difference in terms of eaten products. All weights were collected by means of an Acculab© precision weighing scale with the capacity of 510g of and 0.1g readability.

Statistical analysis

A basic exploratory data analysis was performed on the sample and it was reported using the median (I-III quartile) for continuous variables and the percentages (absolute numbers) for categorical variables, as appropriate.

The main analysis has been based on a linear

model for caloric intake where the blocking factors (i.e., Gender, Age in two classes according to the randomization procedure, and Brand Awareness) have been forced to stay in the models. Repeated measurements were taken into account using the sandwich estimator of Huber-White (18, 19). Specific investigations on single factor-level effects have been conducted using appropriate linear contrasts.

To check for additional confounding factors, a further model, in addition to the base one has been developed, performing a selection among the candidate variables using the AIC criterion in the backward fashion, still forcing the inclusion of the design variables in the model.

In addition, children were identified as "high consumers" if their caloric intake during the experimental session exceeded the top quartile of the observed distribution. The variables related to the probability of being a high consumer were modelled using a logistic regression model, again using the Huber-White estimator for accounting for repeated measurements, and selected via the AIC criterion in a backward fashion.

The analyses have been performed using the R System (20).

RESULTS

Ninety-six children were assessed using the IBAI questionnaire and were selected to participate to the following phases, equally divided by age (6-8 and 9-11 years), gender, (male and females) and brand awareness score. They were unselected for overweight or obesity. The highest median brand awareness score was retrieved in older males (47.00), while the lowest was measured in the younger female group (26.58).

Sample characteristics (assessed by children questionnaire), in accordance to brand visibility and also to TV exposure (no TV, only TV, TV+advertising) are summarized in Table 1 along with their main characteristics in Table 2.

Comparing the caloric intake of the three groups of children (no TV exposure, only TV

TABLE 2. Description of the sample. Summaries for categorical variables are expressed as percentage (absolute numbers in parenthesis) and for continuous variables as I quartile / median / III quartile.

	N	Brand visibility		TV		TV+spot		Combined (N=96)
		No (N=48)	Yes (N=48)	No TV (N=32)	TV (N=32)	TV+spot (N=32)	TV (N=32)	
Child BMI	88	15.26/16.55/17.59	15.30/17.16/19.88	14.96/16.99/18.75	15.30/16.60/18.94	15.27/16.88/18.38	15.28/16.88/18.75	
Mother BMI	85	20.31/22.49/26.97	19.79/20.62/22.43	19.83/21.48/24.93	19.95/20.62/22.53	20.28/21.61/24.61	20.07/21.45/24.61	
Father BMI	80	23.25/24.78/26.22	22.91/24.69/26.54	23.31/25.03/27.16	23.18/24.49/26.17	22.58/24.07/26.22	23.18/24.77/26.36	
N° products eaten in Step 1	96	2.00/3.00/4.00	2.00/3.00/4.00	2.00/3.00/4.00	1.75/3.00/4.00	1.75/2.00/3.00	2.00/3.00/4.00	
N° products eaten in Step 2	96	2.00/3.00/4.00	2.00/3.00/4.00	2.00/3.00/4.25	2.00/3.00/3.25	2.00/3.00/3.25	2.00/3.00/4.00	
Mean calories per session (kcal)	96	148.07/238.11/291.37	101.34/181.10/319.51	134.49/254.25/330.74	120.77/215.53/313.72	112.72/200.19/259.09	120.77/229.45/308.30	
Quantity per session (gr)	96	38.80/60.90/73.68	25.00/44.20/80.70	36.00/65.40/84.90	29.55/54.05/79.85	29.95/51.35/68.45	30.80/57.60/79.30	
N° of people living with the child	95	2/3/3	2/3/3	2/3/4	2/2/3	3/3/3	2/3/3	
Mother unemployed	91	16% (7)	15% (7)	23% (7)	14% (4)	9% (3)	15% (14)	
Father unemployed	84	100% (41)	100% (43)	100% (27)	100% (26)	100% (31)	100% (84)	
N° of rooms in the house	91	2/3/3	2/3/3	2.0/3.0/3.0	2.0/2.5/3.0	2.0/3.0/3.0	2.0/3.0/3.0	
N° of cars/van owned	96	58% (28) 2% (1) 2% (1) 38% (18) 19% (9) 2% (1) 79% (37)	48% (23) 2% (1) 6% (3) 44% (21) 36% (17) 0% (0) 64% (30)	53% (17) 0% (0) 3% (1) 44% (14) 25% (8) 0% (0) 75% (24)	47% (15) 6% (2) 3% (1) 44% (14) 35% (11) 0% (0) 65% (20)	59% (19) 0% (0) 6% (2) 34% (11) 23% (7) 3% (1) 74% (23)	53% (51) 2% (2) 4% (4) 41% (39) 28% (26) 1% (1) 71% (67)	
Health status	94	2% (1) 79% (37)	0% (0) 64% (30)	0% (0) 75% (24)	0% (0) 65% (20)	3% (1) 74% (23)	6% (6)	
Chronic diseases	96	2% (1)	10% (5)	6% (2)	3% (1)	9% (3)	6% (6)	
Presence of headache in the child	95	4% (2) 10% (5) 85% (41)	0% (0) 17% (8) 83% (39)	3% (1) 12% (4) 84% (27)	3% (1) 19% (6) 78% (25)	0% (0) 10% (3) 90% (28)	2% (2) 14% (13) 84% (80)	
Presence of stomachache in the child	94	4% (2) 9% (4) 87% (41)	0% (0) 17% (8) 83% (39)	3% (1) 12% (4) 84% (27)	0% (0) 16% (5) 84% (27)	3% (1) 10% (3) 87% (26)	2% (2) 13% (12) 85% (80)	
Frequency of breakfast	96	4% (2) 2% (1) 94% (45)	4% (2) 8% (4) 88% (42)	9% (3) 3% (1) 88% (28)	3% (1) 9% (3) 88% (28)	0% (0) 3% (1) 97% (31)	4% (4) 5% (5) 91% (87)	

TABLE 2. Description of the sample. Summaries for categorical variables are expressed as percentage (absolute numbers in parenthesis) and for continuous variables as I quartile / median / III quartile. (cont.)

		Brand visibility				TV		TV+spot		Combined	
		N	No	Yes	No TV	TV	TV+spot				
			1.00/1.00/2.00	0.75/1.00/1.00	1.00/1.00/2.00	1.00/1.00/2.00	1.00/1.00/1.25				
Portions of fruit/day		96									
Portions of vegetables/day	0	96	15% (7)	19% (9)	19% (6)	19% (6)	12% (4)			17% (16)	
	1		42% (20)	46% (22)	38% (12)	50% (16)	44% (14)			44% (42)	
	2		40% (19)	33% (16)	38% (12)	28% (9)	44% (14)			36% (35)	
	3		4% (2)	2% (1)	6% (2)	3% (1)	0% (0)			3% (3)	
Fruit and vegetable consumption		96									
	no fruit, no veg		6% (3)	6% (3)	9% (3)	9% (3)	0% (0)			6% (6)	
	fruit and vegetable		8% (4)	12% (6)	9% (3)	9% (3)	12% (4)			10% (10)	
	vegetable		83% (40)	69% (33)	69% (22)	75% (24)	84% (27)			76% (73)	
Chips or snacks		96									
	once a week		2% (1)	12% (6)	12% (4)	6% (2)	3% (1)			7% (7)	
	never		27% (13)	38% (18)	28% (9)	31% (10)	38% (12)			32% (31)	
	rarely		6% (3)	2% (1)	6% (2)	0% (0)	6% (2)			4% (4)	
	once a day		65% (31)	54% (26)	62% (20)	62% (20)	53% (17)			59% (57)	
Sweets or chocolate		96									
	once a week		2% (1)	6% (3)	3% (1)	6% (2)	3% (1)			4% (4)	
	more than once a day		40% (19)	42% (20)	44% (14)	41% (13)	38% (12)			41% (39)	
	rarely		4% (2)	2% (1)	0% (0)	6% (2)	3% (1)			3% (3)	
	once a day		40% (19)	38% (18)	25% (8)	38% (12)	53% (17)			39% (37)	
Biscuits		96									
	once a week		17% (8)	19% (9)	31% (10)	16% (5)	6% (2)			18% (17)	
	never		23% (11)	25% (12)	22% (7)	16% (5)	34% (11)			24% (23)	
	more than once a day		0% (0)	2% (1)	0% (0)	0% (0)	3% (1)			1% (1)	
	rarely		6% (3)	4% (2)	9% (3)	3% (1)	3% (1)			5% (5)	
	once a day		15% (7)	10% (5)	12% (4)	12% (4)	12% (4)			12% (12)	
Sweet snacks		96									
	once a week		56% (27)	58% (28)	56% (18)	69% (22)	47% (15)			57% (55)	
	never		50% (24)	35% (17)	66% (21)	34% (11)	28% (9)			43% (41)	
	more than once a day		12% (6)	0% (0)	6% (2)	3% (1)	9% (3)			6% (6)	
	rarely		0% (0)	4% (2)	3% (1)	0% (0)	3% (1)			2% (2)	
	once a day		25% (12)	38% (18)	16% (5)	41% (13)	38% (12)			31% (30)	
Snack (cakes, pastry, etc)		96									
	once a week		12% (6)	23% (11)	9% (3)	22% (7)	22% (7)			18% (17)	
	never		48% (23)	31% (15)	56% (18)	31% (10)	31% (10)			40% (38)	
	more than once a day		15% (7)	2% (1)	9% (3)	3% (1)	12% (4)			8% (8)	
	rarely		0% (0)	15% (7)	6% (2)	9% (3)	6% (2)			7% (7)	
	once a day		29% (14)	27% (13)	22% (7)	31% (10)	31% (10)			28% (27)	
Fried food, French fries		96									
	once a week		8% (4)	25% (12)	6% (2)	25% (8)	19% (6)			17% (16)	
	never		33% (16)	40% (19)	25% (8)	47% (15)	38% (12)			36% (35)	
	rarely		4% (2)	8% (4)	9% (3)	3% (1)	6% (2)			6% (6)	
	once a day		62% (30)	52% (25)	66% (21)	50% (16)	56% (18)			57% (55)	
Soda		96									
	once a week		27% (13)	29% (14)	31% (10)	31% (10)	22% (7)			28% (27)	
	never		19% (9)	17% (8)	16% (5)	16% (5)	22% (7)			18% (17)	
	more than once a day		8% (4)	2% (1)	3% (1)	6% (2)	6% (2)			5% (5)	
	rarely		42% (20)	31% (15)	41% (13)	25% (8)	44% (14)			36% (35)	
	once a day		4% (2)	21% (10)	9% (3)	22% (7)	6% (2)			12% (12)	

exposure, TV+advertising exposure) when both snacks were branded and unbranded, no significant differences were recorded (Table 3), neither in Step 1 and Step 2. Despite no significant differences, we found out that, in the group of non-visible brand (Step 1), children not exposed to TV presented an intake of 100 kcal higher than those exposed to TV+spot.

Referring to the multivariable model, even after adjustment for potential confounders, we showed no significant association between increased caloric intake and Brand visibility (Table 4).

Figure 2 and Figure 3 report the trends among the two brand awareness groups of total grams

TABLE 3. Energy intake in the experimental grid, expressed as mean Kcaloric intake. SD is given in brackets. No significant differences observed.

Brand Visibility	No TV	TV	TV+spot	Total
Non Visible (N)	16	16	16	48
STEP 1	287.36 (128.36)	233.33 (106.54)	185.06 (100.25)	235.25 (117.77)
STEP 2	290.46 (245.22)	233.83 (106.52)	293.51 (183.07)	272.60 (185.14)
Visible (N)	16	16	16	48
STEP 1	220.59 (174.58)	190.01 (138.99)	227.89 (173.88)	212.83 (160.67)
STEP 2	270.52 (140.23)	237.62 (128.62)	231.67 (123.77)	246.60 (129.39)
Total (N)	32	32	32	96
STEP 1	253.98 (154.50)	211.67 (123.79)	206.47 (141.30)	224.04 (140.58)
STEP 2	280.49 (196.76)	235.73 (116.19)	262.59 (156.90)	259.60 (159.41)

TABLE 4. Multivariable model to assess the association between caloric intake and other parameters recorded with children questionnaires.

	Estimate Std	Error	p-value
(Intercept)	209.93	61.50	<0.001
Age range			
9-11 years old	41.11	25.04	0.104
Male	63.26	24.26	0.010
Brand Awareness (no brand vs brand)	-22.58	27.23	0.409
Brand Visibility (visible vs. non visible)	-24.21	14.47	0.097
N° of cars/van owned - None	-139.87	89.31	0.120
N° of cars/van owned – One car	-158.11	86.74	0.072
N° of cars/van owned – One van	-31.13	25.36	0.222
Fruit portions	49.82	16.24	0.002
Sweets and chocolate			
More than once a day	-173.73	76.13	0.025
Sweets and chocolate			
Rarely	-14.13	28.24	0.618
Sweets and chocolate			
Once a day	-39.64	35.77	0.270

intake in children, exposed or not exposed to TV viewing. Children reporting high brand awareness and not exposed to TV showed lower snacks intake when brand was not visible (Figure 2), while children exposed to TV+advertising showed the same snacks intake when both the snacks were branded and unbranded, this probably because of children's prior preferences towards the snacks, even if we did not investigate them. Additionally, among children with low brand awareness (Figure 3) exposed to TV and TV+advertising, the snack intake was lower when the brand of the snack was visible, this could be related to the fact that TV and TV+ advertising exposure was distracting.

High consumer

The top quartile of energy intake corresponded to 319 Kcal. This value has been chosen as the cut-off to identify the subgroup of 21 children with higher energy intakes during the experimental session in order to investigate factors associated to higher energy intake in this snacking occasion. Table 5 shows the main characteristics of these "high consumer" children. At the multivariable analysis, no significant association was found for the experimental factor TV (p-value 0.251), Brand Visibility (p-value 0.328) or their interaction (p-value 0.177) with the "high consumer" status. The only variable associated with this status turned out to be the age group of the child. Taking the 6-8 year-old age group as reference, the Odds Ratio (OR) of being a "high consumer" was 0.45 (95% C.I. 0.23-0.89) for older children in the age group 9-11 years.

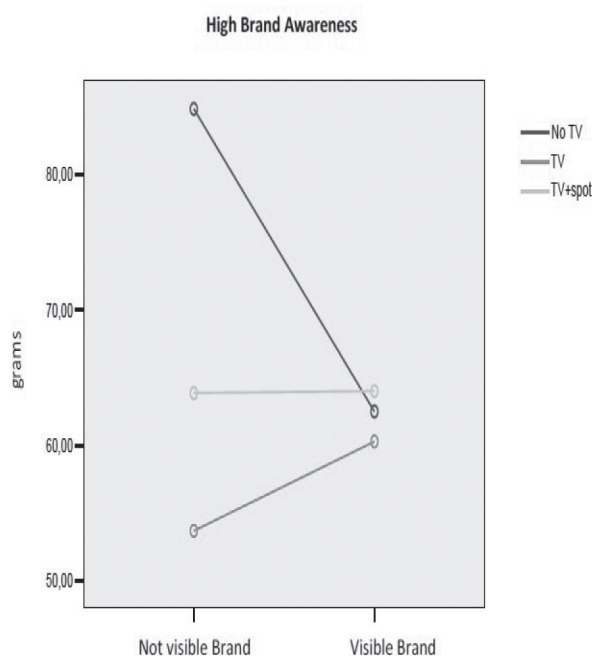


FIGURE 2. Trends of energy intake among children of the high brand awareness group, exposed or not exposed to TV viewing and package's brand.

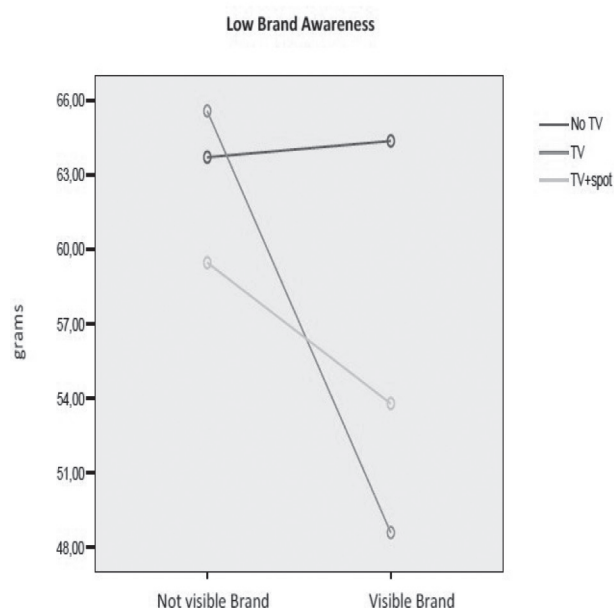


FIGURE 3. Trends of energy intake among children of the low brand awareness group, exposed or not exposed to TV viewing and package's brand.

TABLE 5. Characterization of the High Consumers according to the main study variables. Values for the categorical variables are expressed as a percentage (absolute numbers in parenthesis) and those for the continuous variables as the median (I quartile / median / III quartile).

Variable	Levels	N	High (N=21)	Low (N=75)	p-value
Gender	Male	96	57% (12)	48% (36)	0.459
Age	9-11 years	96	8/10/10	7/8/10	0.031
Brand Awareness	Low	96	48% (10)	51% (38)	0.805
TV : No TV		96	43% (9)	31% (23)	0.481
TV			33% (7)	33% (25)	
TV+spot			24% (5)	36% (27)	
Brand Visibility	Visible	96	57% (12)	48% (36)	0.459
Child BMI		88	15.43934/16.99524/18.79983	15.27619/16.76608/18.43674	0.84
Mother BMI		85	20.29787/22.16496/25.52073	20.06920/21.25850/23.43750	0.44
Father BMI		80	24.47132/26.04167/27.73661	22.77319/24.15167/26.21882	0.062
N° products eaten in Step 1		96	4/5/6	1/2/3	-
N° products eaten in Step 2		96	3/5/5	2/2/3	-
Mean calories per session (kcal)		96	356.320/395.439/465.698	99.836/165.045/246.694	-
Quantity per session (gr)		96	90.90/ 98.00/127.50	25.70/ 42.70/ 63.05	-
N° of people living with the child		95	2/3/4	2/3/3	0.152
Unemployed mother		91	26% (5)	12% (9)	0.138
Unemployed father		84	100% (18)	100% (66)	
N° of rooms in the house		91	2/3/3	2/3/3	0.239
N° of cars/van owned	2 or more	96	57% (12)	52% (39)	0.616
	none		0% (0)	3% (2)	
	one car		0% (0)	5% (4)	
	one van		43% (9)	40% (30)	
Health staus	good	94	29% (6)	27% (20)	0.862
	discrete		0% (0)	1% (1)	
	excellent		71% (15)	71% (52)	
Chronic diseases		96	5% (1)	7% (5)	0.75
Presence of headache in the child	once a week	95	5% (1)	1% (1)	0.273
	once a month		5% (1)	16% (12)	
	never/rarely		90% (19)	82% (61)	

TABLE 5. Characterization of the High Consumers according to the main study variables.
 Values for the categorical variables are expressed as a percentage (absolute numbers in parenthesis)
 and those for the continuous variables as the median (I quartile / median / III quartile). (Cont.)

Variable	Levels	N	High (N=21)	Low (N=75)	p-value
Presence of stomach ache in the child	once a week once a month never/rarely	94	0% (0) 24% (5) 76% (16)	3% (2) 10% (7) 88% (64)	0.182
Presence of back pain in the child (never/rarely)		94	100% (21)	99% (72)	0.59
Presence of malaise in the child (never/rarely)		94	95% (20)	96% (70)	0.896
Presence of fatigue in the child	once a week once a month never/rarely more than once a week	94 94	5% (1) 10% (2) 86% (18) 0% (0)	3% (2) 4% (3) 90% (66) 3% (2)	0.632
Frequency of breakfast	3-4 days per week never every day	96	5% (1) 5% (1) 90% (19)	4% (3) 5% (4) 91% (68)	0.984
Portions of fruit/day		96	1/1/2	1/1/2	0.162
Portions of vegetables/day	0 1 2 3	96	10% (2) 48% (10) 33% (7) 10% (2)	19% (14) 43% (32) 37% (28) 1% (1)	0.212
Fruit and vegetable consumption	no fruit, no veg fruit and vegetable vegetable	96	5% (1) 81% (17) 10% (2)	12% (9) 75% (56) 7% (5)	0.756
Chips or snacks	once a week never rarely once a day	96	38% (8) 0% (0) 62% (13) 0% (0)	31% (23) 5% (4) 59% (44) 5% (4)	0.466
Sweets or chocolate	once a week more than once a day rarely once a day	96	43% (9) 0% (0) 43% (9) 14% (3)	40% (30) 4% (3) 37% (28) 19% (14)	0.758
Biscuits	once a week never more than once a day rarely once a day	96	19% (4) 5% (1) 14% (3) 5% (1) 57% (12)	25% (19) 0% (0) 3% (2) 15% (11) 57% (43)	0.052
Sweet snacks	once a week never more than once a day rarely once a day	96	48% (10) 0% (0) 5% (1) 43% (9) 5% (1)	41% (31) 8% (6) 1% (1) 28% (21) 21% (16)	0.167
Snack (cakes, pastry, etc)	once a week never more than once a day rarely once a day	96	48% (10) 10% (2) 5% (1) 24% (5) 14% (3)	37% (28) 8% (6) 8% (6) 29% (22) 17% (13)	0.911
Fried food, French fries	once a week never rarely	96	33% (7) 5% (1) 62% (13)	37% (28) 7% (5) 56% (42)	0.875
Soda	once a week never more than once a day rarely once a day	96	29% (6) 19% (4) 0% (0) 38% (8) 14% (3)	28% (21) 17% (13) 7% (5) 36% (27) 12% (9)	0.824

DISCUSSION

This study was conducted among a sample of Italian children, where TV advertising it is demonstrated to be similar to those in other countries and in particular in US. A study published in 2010 (21), comparing food advertising in children's TV channels of Europe, America, Australia and Asia, demonstrated that food is one of the most advertised products in all the countries involved in the study. However, regarding the type of food advertised, it found differences among Italian and US advertising, showing that fast food and chocolate/confectionary are the most common marketed products in US and Italy respectively. These results are consistent with a study (22) conducted on Italian food advertising for children which revealed that sweets were the products most frequently advertised.

The existence of an association between TV, advertising and risk of being overweight or obese has been evaluated in numerous studies(23-25), obtaining contrasting results. This study aimed at understanding the association between food consumption during snacking times, brand visibility and TV viewing.

With respect to the primary objective of the study, the assessment of the effect of TV viewing and brand advertising, the present study showed no significant effect on total energy intake. The secondary objective was to evaluate the effect of different levels of brand awareness on children's intake. Similarly to the previous results, no significant association of increased intake was recorded in any of the two brand awareness groups, showing similar trends also for brand and TV exposure.

The results of the present study disagreed with previous research studies, where a positive association was found between advertising and TV viewing and increased energy intake. Halford and colleagues showed that 9-11-year-old (26) and 5-7 year-old (27) children increased their intake of most food types after viewing

food adverts, and that the ability to correctly recognize these food adverts was significantly associated with higher food intake following food advert exposure. Similar conclusions were found by Lobstein, that in 2004 stated that the overall findings justified the need for taking precautionary measures to reduce children's exposure to obesogenic marketing practices (11).

In our study, no significant association between brand visibility and increased caloric intake was found, neither in children with high brand-awareness nor in those with low brand-awareness. Children showed a somewhat homogeneous overall intake with a median of 3 snacks per child.

When considering solely the effect of a brand on children's snack intake, it resulted that if the packages were unbranded, children (in particular, males) tended to consume a higher number of grams of snacks, therefore increasing their caloric intake. These findings were consistent with those in Anschutz's research, which highlighted in boys an increased susceptibility to food cues in food commercials (28).

As suggested also from the research of Francis, TV viewing could either increase or decrease children's food intakes (25). Specifically, our study showed that in low awareness children, both TV groups experienced a decreased intake of snack when switching from unbranded towards branded packages. Additionally, children not exposed to TV showed an increased intake with branded snacks in comparison with unbranded snacks. Results were nonetheless not significant. Children seemed to be more prone to eat when they weren't distracted from any other factor, while TV viewing and brand presence didn't modify their eating behavior towards a larger request of snacks. These findings were not in line with previous ones, which associated increased snacking behavior with screen time (29).

A multivariable model was used to assess the association between increased caloric

intake and other parameters recorded with children questionnaires. In the present sample, confectionery's habitual consumption appeared to be a protective factor, showing a decreasing effect on overall caloric intake, while being a male and belonging to an older group showed a boosting effect on energy intake.

As a study limitation, it must be taken into consideration that this body of evidence emerges from an experimental study whose results can be extrapolated in the real life with caution. Nevertheless, all efforts were made to minimize biases. All the participating children attended the same school, attending the same meal supply chain and were brought in to the experimental area by their parents, not having eaten any other item before the study. In addition, the *ad libitum* method allowed us to focus our attention on the children's satiety point, giving them complete freedom while they were eating the chosen snacks, without any intervention of the interviewer in terms of neither limiting their choices nor highlighting the presence of the brand on the children's trays. Finally, we did not investigate children's preferences towards the snacks presented in the study and consequently we could not evaluate the effect of children's attitudes on energy intake.

Implications for Research and Practice

The present study failed to prove, in an afternoon snacking occasion, an effect of TV viewing and advertising in children, even when considering the high brand awareness subgroup. While breakfast habits and their effects have been largely investigated, the role of afternoon snacking has been less studied, both from nutritional and from behavioral point of view. However, it's crucial to widely study this snacking occasion in children, because afternoon snack presents unique characteristics that differentiate it from morning snack, especially in Italian context. While in the morning children have snack at school (which could also provide snacks, such as fruits

or yogurt, as in some Italian school facilities implementing project for healthy nutrition), in the afternoon children have snacks usually outside school so they could be exposed to TV viewing (and consequently to TV spot).

Our results might indicate that children's attitudes to food during afternoon snacking is less modified by exposure to known and common factors like television and advertising. Further research is needed in order to guide health policies aimed at fighting childhood obesity epidemic.

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CONFLICTS OF INTEREST

The authors have no competing interests

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