



Digital Food Marketing on Social Networking Sites: Exposure, Engagement, and association with Overweight/Obesity among Medical Students in An Egyptian University

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ABSTRACT

Background: Digital food marketing on social networking sites (SNS) can significantly impact young people's food choices and increase consumption of unhealthy foods, snacking, and disordered eating behaviors. **Objective:** To describe the SNS use patterns, exposure to, and engagement with SNS food marketing among medical students. **Method:** A cross-sectional study was carried out on a convenience sample of 706 medical students. An online survey was used to collect sociodemographic data, type, and frequency of SNS use. **Results:** Participants were mostly females (57.93%), with a mean age of 20.77 ± 1.98 years. Approximately 43.2% of the participants were overweight or obese. Out of 706 participants, 157 (22.2%) reported daily exposure to any SNS food marketing, and 190 (26.9%) fell in the high engagement category. Daily exposure to food marketing was significantly associated with daily SNS use for two hours or more ($p=0.006$). Earlier age of onset of SNS use, number of SNS accounts, and two hours or more of daily SNS use were associated with higher engagement ($p<0.001$). Binary logistic regression showed no significant association between overweight/obesity-adjusted for age, gender, and physical activity- and daily exposure or high engagement with digital food marketing. **Conclusions:** Students with intense SNS use showed higher levels of exposure to and engagement with SNS food marketing. Daily exposure and high engagement were not independent predictors of overweight or obesity. There is a need to explore other factors that may be implicated in the association between SNS food marketing and overweight/obesity apart from the mere dose of exposure and engagement.

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INTRODUCTION

The current obesogenic food environment promotes overconsumption of energy-dense foods and increases the prevalence of overweight and diet-related non-communicable diseases.^{1,2} In January 2023, nearly 46.25 million Egyptians, or 41.4% of the country's entire population, were active social media users. 42.10 million people, or 60.9% of the population over

the age of 18, use social media.³ Given their exposure to and familiarity with these platforms as "digital natives" who grew up in the digital age, most young adults utilize social media sites as part of their usual daily routine.⁴ Food advertising significantly affects young people's food preferences, decision-making processes, timing, consumption, and social norms. It

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builds brand loyalty and emotionally connects with customers, potentially leading to negative health consequences.⁵ Exposure to digital food marketing on social networking sites promotes the consumption of unhealthy, sugar, salt, and fat-rich foods, and encourages overeating and snacking, which can later impact body image and contribute to disordered eating behaviors.⁵⁻⁸

Digital food marketing on social media sites (SNS) like Facebook, YouTube, Instagram, and Twitter contributes significantly to this trend as the food industry shifts its marketing spending to this cost-effective medium.^{1,2} Digital marketing delivers personalized commercial messages to targeted audiences using targeted methods and high volumes, surpassing traditional media. Customized digital marketing campaigns can be particularly effective among young people, who constitute more than 70% of social media users.⁹ Young people's frequent use of social media enhances the potential for continuous monitoring of social interactions by the food industry.^{8,10} Studies have indicated that food and beverage companies create highly engaging content on social media that seamlessly integrates with the daily lives of young people. Furthermore, young audiences can recall energy-dense, nutrient-poor food advertisements more easily than advertisements promoting healthy food options.^{11,12}

Social media engagement measures interactions between a brand or individual and their followers on social media platforms and is critical for assessing social media marketing performance.¹³ Young adults engage with food-related content on social media by sharing photos of food, following bloggers and influencers, participating in food challenges, sharing recipes and tips, and discussing food-related topics. Understanding digital food marketing patterns on social networking sites can help identify potential negative effects and inform more effective public health interventions, such as regulating unhealthy food marketing on social media.^{14,15}

This study aims to describe the usage patterns of social networking sites as well as the exposure to and engagement with digital food marketing on SNSs among medical students and its relation to overweight and obesity.

METHODS

A cross-sectional study was carried out among medical students at a public university in Cairo, Egypt. Data collection extended from September 2021 to September 2022.

Sample size was calculated as 700 students based on the assumption of 50% engagement with digital food marketing on social media, with a margin of error of 5% and a confidence level of 99%. Out of 725 students who were invited to participate in the survey, 706 (97.37%) responded.

Data collection: An online Arabic survey (Microsoft form) was used. The form was posted on students' official social media groups across several platforms, including Facebook and WhatsApp, as well as the students' e-learning portal. The survey consisted of two sections: *Section A:* included data on sociodemographic characteristics such as age, gender, nationality, academic level, parents' education and occupation, place of permanent residence, medical history, number of family members, average monthly expenses, whether the participant has a job besides studying, and physical activity of the participants.^{16,17} Participants self-reported their height and weight and mentioned whether they follow a dietary regimen to manage their weight. Body Mass Index was calculated.¹⁸

Section B: included items to assess the use of social networking sites (SNSs). A series of questions was adapted from Ali et al., 2021¹⁹, including the time duration spent on SNSs per day (in minutes), the duration (in years) of SNS membership, the preferred device to access SNSs through (mobile or laptop), the number of active SNS accounts, the frequency of using each platform, and the type of content consumed on SNSs. To evaluate exposure to digital food marketing on social networking sites (SNSs), the researcher used five-option Likert scale questions (ranging between 0=never and 4=daily). Questions were adapted from Cavazos-Rehg et al., 2021²⁰, to assess the frequency of exposure to SNS content for fast food, pastry, dessert, and/or soft drink brands, food bloggers, and pages related to cooking education. To assess students' engagement with social media food marketing, the researcher used eight items to measure four engagement levels, namely: acknowledgment (2 items), association (2 items), amplification (1 item), and action (3 items).

Table 1: Socio-demographic characters and SNS use profile of the study participants.

	No.	%
Gender		
Male	297	42.07
Female	409	57.93
Permanent residence		
Metropolitan *	368	52.12
Lower Egypt	231	32.72
Upper Egypt	68	9.63
Foreign country	39	5.52
Family size		
< 5	293	41.50
≥ 5	413	58.50
Highly Education of Mother		
Working Mother	397	56.23
Working student	64	9.07
Body mass index **		
Underweight	29	4.11
Normal	372	52.69
Overweight/Obese	305	43.20
Chronic illness		
Practice sports	145	20.54
Regular ***		
None	350	49.58
Irregular	291	41.22
Regular ***	65	9.21
Dieting		
Dieting	147	20.82
Number of SNS accounts		
≤ 3	417	59.07
> 3	289	40.93
Age of SNS use onset		
≤ 13 years	384	54.39
> 13 years	322	45.61
Average daily duration		
≤ 120 minutes	297	42.07
> 120 minutes	409	57.93

* Cairo, Alexandria, Port-Said ** BMI categories: Underweight <18.5, Normal 18.5-24.9, overweight ≥ 25 *** Regular (At least for 30 min./ 3 times a week)

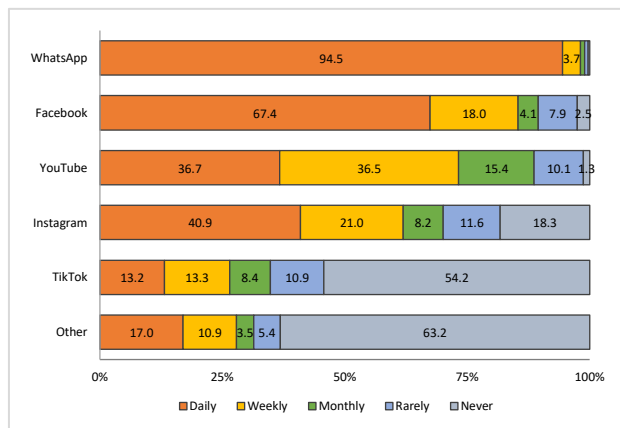


Figure 1: Frequency of the use of different Social Networking Sites by the study participants (n=706)

The frequency of each item was measured on a five-option Likert scale (ranging between 0=never and 4=daily). Acknowledgment included watching or liking/reacting to content; association involved commenting or replying to content; amplification involved sharing/retweeting content, and action involved taking steps such as subscribing, purchasing, or using food delivery apps. ^{21,22}

Pilot Study: A pilot study lasting two weeks was performed on a sample of 70 medical students at the designated university. The pilot aimed to assess questionnaire comprehension and clarity of wording. None of the proposed questions were deleted or modified. Completing the questionnaire took, on average, 13 minutes. Pilot data was not included in the study.

Data analysis: Data analysis was performed using the Statistical Package for Social Sciences (SPSS for Windows Version 25). Quantitative variables were presented as mean, standard deviation, and range. Frequency and percentage were used to describe categorical variables. The Chi-square test was used to examine the association between categorical variables, and a p-value ≤0.05 was considered statistically significant. A binary logistic regression was conducted to determine the factors associated with overweight/obesity. The highest frequency of exposure to any social media food marketing (ranging from 0=never to 4=daily) was taken as the overall measure of exposure. The frequency of each engagement level was considered to be the highest frequency scored on any of its component items. The four engagement levels, namely: acknowledgment, association, amplification, and action were given the following weights: 0.1, 0.2, 0.3, and 0.4, respectively. The frequency of each engagement level was multiplied by its weight and the product; for each of the four levels was summed to yield the total engagement score. The total engagement score ranged between 0 and 4. A higher score indicates higher engagement.

RESULTS

Table (1) shows the sociodemographic characteristics of the participants. The study population consisted of 706 medical students with a mean age of 20.77±1.98 years. More than half of the participants (409, 57.93%) were females, and 627 (88.81%) were Egyptians. Body mass index (BMI) was calculated, and 43.20% of the participants were either overweight or

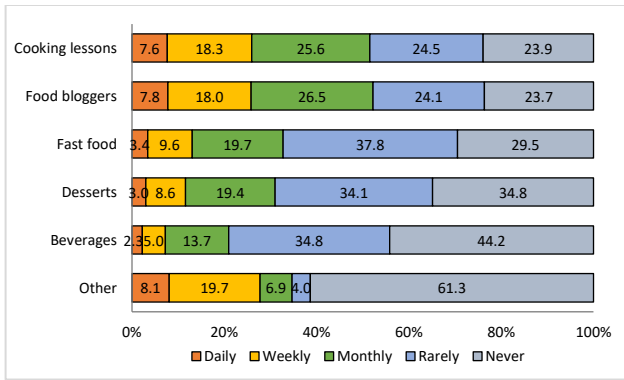


Figure 2: Frequency of exposure to types of digital food marketing on Social Networking Sites among the study participants (N=706)

obese, while only 4.11% were underweight. Out of 706 students, 20.54% indicated that they had a chronic health condition, of whom 72 (10.20%) had neuropsychiatric illnesses, 50 (7.80%) had allergic or immune diseases, and 45 (6.37%) had gastrointestinal (GIT) and/or metabolic diseases. Most of the participants (49.58%) reported not practicing sports, 41.22% were engaged in sports irregularly, and only 9.21% regularly practiced sports for at least 30 minutes per day, three times a week.

Most participants (628, 88.95%) mainly used a phone or a tablet to access SNSs, 21 (2.97%) used mainly a personal computer (PC) or a laptop, and 57 (8.07%) used both equally. The mean age at first social media usage was 13.36 ± 2.95 years. Regarding the number of social media accounts, 59.07% of the respondents had three accounts or less, and 40.93% had more than three accounts. More than half of the participants (57.93%) spent more than two hours per day on social media. (Table 1).

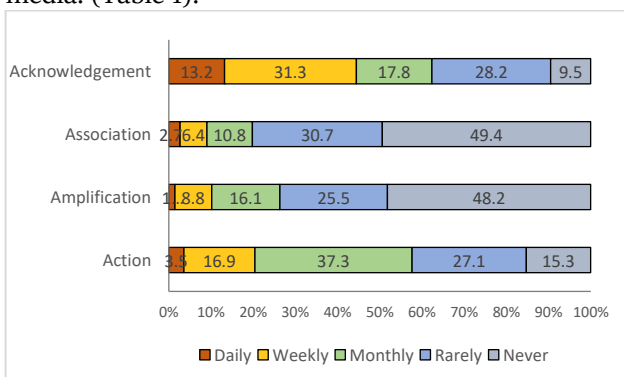


Figure 3: Frequency of engagement level with digital food marketing on Social Networking Sites among the study participants (N=706)

Out of 706 participants, 701 (99.29%) used at least one SNS daily. WhatsApp, Facebook, and Instagram

were the most frequently used social networking sites among the participants, with daily usage rates of 94.5%, 67.4%, and 40.9%, respectively. 36.7% of the participants used YouTube daily, while 13.2% and 17%, respectively, of the participants used TikTok and other platforms daily (Figure 1).

Four hundred and fifty-eight (64.87%) of the participants reported exposure to digital food marketing at least weekly, of whom 157 (22.24% of the total sample) reported daily exposure. When considering daily exposure, cooking lessons (7.6%) and food bloggers (7.8%) were the highest, followed by fast food, desserts, and beverages, as depicted in Figure (2).

Figure (3) presents the frequency of each engagement level among the study participants. More than half (377, 53.40%) of the participants were engaged at some level with digital food marketing at least weekly, of whom 112 (15.86% of the total sample) did so daily. The proportions of daily engagement were as follows: 13.2% for acknowledgment (watching video or liking), 2.7% for association (commenting/replying or using brand hashtags), 1.4% for amplification (sharing), and 3.5% for action (subscribing, purchasing post-viewing promotional offers, or using food delivery apps).

The total engagement score was calculated for all participants and was divided into four quartiles as follows: Low: < 0.7, Fair: 0.7-1.1, Moderate: 1.2-1.8, High: ≥ 1.9 . Table (2) shows the association between participants' characteristics, daily exposure, and high engagement. There was no statistically significant association between age and daily exposure or high engagement. Daily exposure was significantly associated with permanent foreign residence ($p=0.009$) and following a dietary regimen ($p<0.001$). Students who used SNSs for more than two hours per day had a higher likelihood of reporting daily exposure to SNS food marketing ($p=0.006$).

Female students were more likely to fall in the high engagement category compared to male students ($p=0.040$). The same tendency was also seen in students from Upper Egypt ($p=0.032$), and those with fewer than five household members ($p=0.002$). Furthermore, students who work, do not practice sports, and have chronic illnesses were more likely than their peers to fall into the high engagement category ($p = 0.045, 0.045, \text{ and } <0.001$, respectively). Additionally, students with more than three SNS accounts and those who were exposed to SNSs before

Table 2: Association between socio-demographic characters and daily exposure and high engagement (Total engagement score ≥1.9)

	N	Daily Exposure N=157			High Engagement N= 190		
		N	Row%	P value	No.	Row%	P value
Gender							
Male	297	64	21.55	0.707	68	22.90	0.040*
Female	409	93	22.74		122	29.83	
Permanent residence							
Metropolitan	368	74	20.11 ^a	0.009*	99	26.90 ^{a,b}	0.032*
Lower Egypt	231	49	21.21 ^a		51	22.08 ^b	
Upper Egypt	68	17	25.00 ^a		26	38.24 ^a	
Foreign land	39	17	43.59 ^b		14	35.90 ^{a,b}	
Family size							
< 5	293	75	25.60	0.071	97	33.11	0.002*
≥ 5	413	82	19.85		93	22.52	
Mother's high education							
Yes	523	122	23.33	0.239	144	27.53	0.529
No	183	35	19.13		46	25.14	
Mother working							
Yes	397	95	23.93	0.221	113	28.46	0.292
No	309	62	20.06		77	24.92	
Working student							
Yes	64	16	25.00	0.577	24	37.50	0.045*
No	642	141	21.96		166	25.86	
Overweight/ Obese							
Yes	305	70	22.95	0.691	88	28.85	0.311
No	401	87	21.70		102	25.44	
Chronic illness							
Yes	145	36	24.83	0.400	63	43.45	<0.001*
No	561	121	21.57		127	22.64	
Practice Sports							
Yes	356	81	22.75	0.740	84	23.60	0.045*
No	350	76	21.71		106	30.29	
Dieting							
Yes	147	49	33.33	<0.001*	40	27.21	0.927
No	559	108	19.32		150	26.83	
SNS Accounts							
≤ 3	417	92	22.06	0.893	73	17.51	<0.001*
> 3	289	65	22.49		117	40.48	
Age of onset							
≤ 13	384	86	22.40	0.912	127	33.07	<0.001*
> 13	322	71	22.05		63	19.57	
Average daily SNS use							
≤ 120	297	51	17.17	0.006*	100	33.67	0.001*
> 120	409	106	25.92		90	22.00	

Chi square test was used. Significant difference is considered at $p \leq 0.05$. Each superscript letter denotes a subset of categories whose column proportions do not differ significantly from each other at the .05 level.

the age of 13 were more likely to fall in the high engagement category ($p < 0.001$), as were those who used SNSs for more than 120 minutes per day on average ($p = 0.001$) (Table 2).

Using a binary logistic regression model, no statistically significant association was found between daily exposure, high engagement, and

overweight/obesity outcome with adjustment for age, gender, and physical activity (Table 3).

DISCUSSION

Over 40% (43.20%) of students in the current study were overweight/obese. This finding is consistent with a prior study of Egyptian university students'

Table 3: Binary logistic regression exploring the relation between overweight/obesity and the studied variables.

Independent variables	B	S.E.	Wald	df	P value	OR	95% C.I for OR	
							Lower	Upper
Age	0.110	0.039	7.909	1	0.005*	1.116	1.034	1.205
Gender (Female)	-0.078	0.161	0.236	1	0.627	0.925	0.675	1.267
Practice Sports (Yes)	-0.320	0.158	4.081	1	0.043*	0.726	0.533	0.991
Daily Exposure (Yes)	-0.047	0.198	0.056	1	0.813	0.954	0.647	1.408
Engagement score	0.125	0.099	1.574	1	0.210	1.133	0.932	1.376
Constant	-2.505	0.839	8.923	1	0.003	0.082		

Dependent variable: Overweight/ obesity (BMI > 25); Chi square = 14.287, df=5, P=0.014

nutritional status, in which almost half of the students were overweight or obese.²³ Medical students are generally thought to be at higher risk of obesity due to their sedentary lifestyles, disordered eating patterns, and reduced physical activity.²⁴

Most participants (54.39%) in our study began using SNSs at an early age, around 13 years old, and almost all participants used at least one SNS daily, with many having multiple accounts, averaging three accounts per person. Previous reports also asserted that Egyptian young people spend a significant duration of time on SNSs. An online survey in the first quarter of 2023 revealed that Egyptians spent an average of 2 hours and 40 minutes daily on social media.²⁵

Nearly two-thirds of participants in the current study experienced SNS food marketing at least weekly, and more than one-fifth (22.24%) reported daily exposure. A recent research paper examining adolescents' exposure to and evaluation of food advertising on social media revealed a significant increase in adolescents' exposure to food marketing since 2019.²⁶

More than half of the students (53.40%) in the current study engaged with digital food marketing at least weekly, and over 15% (15.86%) reported daily engagement, with video liking being their most prevalent form of engagement. A study conducted in 2022 revealed that unhealthy food images received more engagement, with more likes, shares, and comments, compared to posts featuring healthy food.²⁷

Our research indicates that the permanent residence of individuals significantly affects their exposure to and engagement with digital food marketing. These variations may be attributed to disparities in internet access, media consumption habits, and marketing approaches in different geographical areas. In Mexico, a study revealed that 45% of children and adolescents

who had access to Wi-Fi at home were more exposed to digital marketing for unhealthy food and beverages, especially.²⁸

In the current study, individuals who followed a specific diet had higher exposure levels to digital food marketing. Students following a diet regimen would probably be interested in searching for food content and, hence, experience a higher frequency of food marketing, both healthy and unhealthy. A systematic review explained that social media platforms use targeted advertising and content recommendations to cater to individuals' dietary interests. They show relevant advertisements and content related to low-carb diets, gluten-free diets, and keto diets to individuals who have expressed interest in these dietary preferences.²⁹ Despite reporting higher exposure, students following a diet in the current study did not show higher engagement. In addition, students who practiced sports in the current study showed significantly less engagement with SNS food marketing compared to those who did not. These observations indicate that behavioral inclinations toward a healthy lifestyle that translate into action may also be reflected in individuals' responses to SNS food marketing.

In the current study, females showed higher engagement than males. Consistent with our findings, the literature highlights that the food and beverage industries employ gender-specific marketing strategies.³⁰ Additionally, a study in Saudi Arabia suggested that female adolescents show a higher tendency to engage with unhealthy food and beverage brands on social media platforms.³¹

In the current study, students who used social media more frequently were found to have higher exposure to and engagement with food-related advertisements. The literature also suggests that students who spend more time on social media are exposed to a higher

number of food-related posts and advertisements and potentially higher engagement.²⁷

Daily exposure and high engagement were not reliable predictors of overweight or obesity in the current study; rather, age and participation in sports appeared to have a bigger impact on weight. Studies have uncovered substantial connections between the increased promotion of non-nutritious foods and the rising obesity rates among children. Furthermore, overweight or obese children were shown to be more vulnerable to the influence of such marketing and tend to consume more high-fat, sugar, and salt (HFSS) foods.^{32,33} However, the effects of digital food marketing on young adults' weight were understudied. Continued research is needed to fully understand the relationship between daily exposure and high engagement with digital food marketing and overweight or obesity in young adults.^{8,31}

Limitations: The current study had a large sample size, but it was limited to volunteer participants from one medical college at a public university in Cairo. As a result, the findings might lack generalizability in other settings or contexts. Additionally, self-reporting may have introduced response bias, particularly regarding the participants' perceptions of their weight and physical activity.

CONCLUSIONS

Almost all participants in the present research were active social media users. Students with intense use of social networking sites (SNSs) showed increased levels of exposure to and engagement with SNS food marketing. Daily exposure and high engagement were not independent predictors of overweight or obesity. There is a need to explore other factors that may be implicated in the link between SNS food marketing and overweight/obesity among young adults, apart from the mere dose of exposure and engagement.

Ethical considerations

The designated university's ethical committee gave its approval to the study protocol. Informed online consent was obtained from the study participants before completing the survey. The consent clarified the aim of the study, stressing that participation in this study was voluntary and that the data was used for research purposes only. The study obtained all required approvals from the Institutional Review

Board of Faculty of medicine, Ain Shams University (Approval number: FMASU MS 403/2021).

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