

INFLUENCE OF SMARTPHONE USE ON HYGIENE AND SOCIAL INTERACTION AMONG YOUNG DINERS

INFLUENCIA DEL USO DE TELÉFONOS INTELIGENTES EN LA HIGIENE Y LA INTERACCIÓN SOCIAL ENTRE JÓVENES COMENSALES

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Abstract - Smartphone use during meals continues to raise concerns regarding hygiene practices and social interaction among diners. This study examined the behavior of 104 young diners in a fast-food restaurant using unobtrusive observation based on security camera recordings. Smartphone use was highly prevalent, accounting for 42.68% of the total time spent in the restaurant. During the meal, 93% of diners used their phones, and 71% did not clean their hands or fingers after handling the device and before eating. Inferential analyses revealed statistically significant positive associations between smartphone handling frequency during meals and hygiene lapses, whereas total smartphone use time was not significantly associated with level of social interaction. Although 16% of diners showed minimal or no interaction with their companions, 84% maintained moderate or active face-to-face communication. These findings suggest that hygiene risks during meals are more closely related to the frequency of phone handling than to overall use duration. They also indicate that, despite frequent smartphone use, direct social interaction remains present in most young diners. The results highlight the importance of promoting responsible smartphone use during meals, particularly in relation to hygiene practices.

Key words – Addiction, Hygiene, Social interaction, Young, Mobile phones.

Resumen -- El uso de teléfonos inteligentes durante las comidas sigue generando preocupación en relación con las prácticas de higiene y la interacción social entre los comensales. Este estudio examinó el comportamiento de 104 jóvenes comensales en un restaurante de comida rápida mediante observación no intrusiva basada en grabaciones de cámaras de seguridad. El uso del teléfono inteligente fue altamente prevalente, representando el 42.68% del tiempo total de permanencia en el restaurante.

Durante la comida, el 93% de los comensales utilizó su teléfono, y el 71% no limpió sus manos o dedos después de manipular el dispositivo y antes de comer. Los análisis inferenciales revelaron asociaciones positivas estadísticamente significativas entre la frecuencia de manipulación del teléfono durante las comidas y las fallas de higiene, mientras que el tiempo total de uso del teléfono no se asoció de manera significativa con el nivel de interacción social. Aunque el 16% de los comensales mostró una interacción mínima o nula con sus acompañantes, el 84% mantuvo una comunicación cara a cara moderada o activa. Estos hallazgos sugieren que los riesgos de higiene durante las comidas están más estrechamente relacionados con la frecuencia de manipulación del teléfono que con la duración total de uso. Asimismo, indican que, a pesar del uso frecuente del teléfono inteligente, la interacción social directa sigue estando presente en la mayoría de los jóvenes comensales. Los resultados destacan la importancia de promover un uso responsable del teléfono inteligente durante las comidas, particularmente en lo relativo a las prácticas de higiene.

Palabras Clave: Adicción, Higiene, Interacción social, Joven, Teléfono móvil.

INTRODUCTION

Smartphones have evolved from simple communication tools to multifunctional hubs for entertainment, work, and daily life management. This transformation has led to a profound influence on various aspects of human behavior, including communication, learning, and relaxation. Consequently, the widespread use of smartphones has not only generated scientific interest but also raised concerns regarding their potential adverse effects, despite their recognized benefits. This duality has driven extensive research into the diverse impacts of problematic or excessive smartphone use across various

health domains[1-3]. Such investigations have predominantly focused on physical and mental health consequences, as evidenced in studies by Cheung [1], Ratan [2], and Wacks and Weinstein [4].

Building upon this body of research, recent studies have also examined the influence of smartphone use on eating behaviors, including increased food intake and mindless eating [5-6] as well as its impact on social interaction [7-8]. However, the intersection of these two aspects—eating behaviors and social interaction—remains underexplored in fast-food restaurant settings, where food is often consumed by hand and social interaction is expected to be a central component of the dining experience. Considering the increasing prevalence of smartphone use among young diners during meals, it becomes crucial to understand how these practices might simultaneously affect hygiene and social interaction [9-10]. Therefore, the present study seeks to address the following research question: How does habitual smartphone use during meals influence both hygiene practices and social interaction among young diners in fast-food restaurants? Identifying such patterns can provide valuable insights into the potential public health implications associated with mobile device use in everyday dining contexts.

Furthermore, concerns regarding hygiene practices associated with frequent smartphone use have garnered growing attention in literature. These ubiquitous devices, often exposed to warmth, dust, and perspiration, can serve as reservoirs for various bacteria and other pathogenic microorganisms [9-11]. Research has demonstrated that these microorganisms can transfer from smartphones to users' hands and faces, thereby increasing the risk of infectious disease transmission. Notably, studies have identified the presence of bacteria such as *Escherichia coli*, *Salmonella*, *Staphylococcus aureus*, and *Clostridium perfringens* on smartphones [10, 12-15]. This concern is particularly relevant in dining settings, where the simultaneous handling of food and smartphones may facilitate bacterial transmission.

The potential health risks associated with smartphone use during meals are further exacerbated when individuals engage with their devices while eating [16-19]. This behavior often involves an unconscious alternation between handling the phone and consuming food, frequently without adequate hand hygiene. Such practices establish a direct pathway for the transfer of contaminants from hands to food, increasing the likelihood of bacterial transmission [13, 20-21]. This concern is particularly relevant in a country like Mexico, where a wide variety of traditional dishes and snacks are typically consumed by hand, thus intensifying the potential for contamination.

In addition to hygiene concerns, frequent smartphone use has been identified as a disruptive factor in social interactions [7, 22-23]. The phenomenon commonly referred to as “phubbing”—the act of ignoring individuals present in favor of interacting with one's smartphone—has been shown to negatively impact the

quality of interpersonal relationships [24-26]. Such behavior not only hinders effective communication but also reduces empathy and mutual understanding, as several studies have demonstrated [7, 24-28]. Given that fast-food restaurants often serve as social settings for young diners, understanding how smartphone use affects both hygiene practices and social dynamics within these contexts becomes essential. Thus, this study seeks to assess the prevalence of smartphone use during meals in contemporary dining environments, particularly in fast-food restaurants. By examining these behaviors, the research aims to determine the extent to which smartphone use persists in these contexts and its potential consequences for both social interaction and hygiene practices among adolescents and young diners.

Several studies have documented the presence of microorganisms on smartphones in food-related settings, particularly among kitchen staff [13-14, 29]. However, limited attention has been given to the presence of such contaminants among diners [18, 20, 30-32]. This oversight is particularly concerning given the increasing prevalence of smartphone use among young diners [33] and the potential health implications associated with bacterial transmission in dining contexts. Despite extensive research on smartphone use, the intersection between hygiene practices and social interaction during meals remains underexplored, particularly in fast-food settings where hand-to-food contact and socialization are common. Given that mobile devices frequently handled during meals may facilitate bacterial transmission, this study examines these interrelated behaviors to provide empirical insights into their public health implications in dining contexts.

Smartphone use was categorized into three phases — before eating, during the meal, and after eating — allowing for a comparative analysis of usage duration across dining stages. Hygiene practices were assessed through indicators such as hand cleaning, napkin use, and direct hand-to-food contact after handling the phone. Social interaction was classified as minimal, moderate, or active, based on the frequency and duration of exchanges with companions. This framework provides a structured approach to examining how smartphone use in fast-food settings relates to both hygiene lapses and social interaction levels.

METHOD

This study employed a cross-sectional, observational design using a structured and unobtrusive approach to collect data on smartphone use, hygiene practices, and social interaction in fast-food restaurant settings. Data collection took place at a fast-food establishment located in downtown Zapotiltic, Jalisco, Mexico, a city with approximately 30,000 inhabitants. The restaurant was selected because its menu consists mainly of foods typically consumed by hand, such as burgers, chicken wings, and french fries, which facilitated the observation of hygiene behaviors during eating. In addition, its popularity among adolescents and young adults, along

with the availability of complimentary Wi-Fi, made it a suitable setting to observe frequent smartphone use. Participants were selected through visual estimation, focusing on diners aged approximately 12 to 30 years, a group identified as having high smartphone use during meals [33]. Both male and female participants were included. The sample was limited to groups of two or more to allow the observation of both hygiene practices and social interaction. Individuals who did not use a smartphone during the observation period and those who were alone were excluded, as the study focused on the relationship between device use, hygiene, and interaction. This age group selection is consistent with previous research on smartphone use in social dining contexts [3]. To facilitate participant selection, a non-probabilistic convenience sampling method was employed. Participants were selected based on their presence in the dining establishment during the peak hours of 18:00 to 22:00, a timeframe chosen to maximize the likelihood of observing smartphone use during meals. This timeframe was deliberately chosen to align with periods of heightened smartphone use, as documented in prior studies that highlight increased device interaction during social dining hours [3].

To examine diners' behavior, permission was obtained from the restaurant owner to use security camera recordings. In order to preserve natural behavior and avoid the Hawthorne effect, participants were not informed of the observation. The study followed ethical guidelines, ensuring anonymity and privacy at all times [34].

To systematically record observed behaviors, a structured observation guide was developed. The guide included predefined categories for smartphone use, hygiene practices, and social interaction. Smartphone-related variables included frequency and duration of use across different phases of the meal. Hygiene-related variables included hand cleaning, napkin use, hand-to-food contact after handling the phone, finger wiping between phone handling and food contact, the use of one or both hands to manipulate the device, and whether the same fingers used to touch the phone were subsequently used to handle food. Social interaction was classified into three levels—minimal, moderate, and active—based on the frequency and duration of exchanges with dining companions. This structure ensured consistent and comparable data collection across all observations.

Prior to data collection, the observation guide was reviewed by researchers with experience in behavioral observation and public health to support content validity. A pilot test was conducted using a subset of recordings in order to refine the coding categories and improve clarity. Inter-observer agreement was assessed through independent coding by multiple researchers, and discrepancies were resolved through discussion. Although a formal reliability coefficient was not

calculated, consistency was reinforced through repeated cross-review sessions.

Recordings were obtained using HIKVISION DS-2CD1143G0-I(C) cameras equipped with 2.8 mm lenses and 4-megapixel resolution, which provided high-definition video for detailed observation. The recorded data were securely stored on memory devices and later reviewed manually. Each recording was carefully examined to ensure accuracy in coding. The study was conducted over a five-month period (August–December 2025), while the data collection phase took place specifically during September and October, during the selected peak hours. A total of 38 video recordings were analyzed, comprising 104 adolescents and young adults. Gender and approximate age were estimated through visual observation. No personal data were collected, and all information was stored securely. Reliability was further strengthened through cross-review of the recordings by different observers.

Data collection focused on two main aspects: the total time spent in the restaurant and the duration and frequency of smartphone use. Smartphone use was categorized into three phases: before eating (from seating to food arrival), during the meal (while food was being consumed), and after eating (from the end of the meal until leaving the table). For each phase, both duration (in minutes) and frequency (number of interactions) were recorded.

Hygiene practices were assessed through the indicators described above, allowing the identification of potential hygiene lapses associated with smartphone use during meals. In addition, social interaction was categorized according to the frequency and duration of exchanges with dining companions and classified into three levels: minimal, moderate, and active interaction. Minimal interaction was defined as infrequent or brief exchanges, often disrupted by smartphone use. Moderate interaction involved periodic conversation with occasional smartphone use, whereas active interaction was characterized by sustained engagement with minimal or no phone use. These operational categories provided a structured basis for examining, both descriptively and inferentially, whether smartphone use was associated with hygiene lapses and observed levels of social interaction in the fast-food dining setting.

The data were analyzed using descriptive statistics and inferential tests. Descriptive analyses were used to characterize smartphone use across the three meal phases, as well as the observed hygiene practices and levels of social interaction. Spearman correlation analyses were conducted to examine the association between smartphone use variables and both no-cleaning behavior and level of social interaction. In addition, a Kruskal–Wallis test was used to assess differences in total

smartphone use time across the three levels of social interaction.

RESULTS

The demographic profile of the study participants indicated a higher representation of male individuals (56.7%) compared to female individuals (43.3%). The estimated age range of the participants was between 12 and 30 years.

Phone usage

The mean duration of stay for diners at the restaurant was 51 minutes. This period comprised three distinct phases: an average of 20 minutes spent waiting for food, 19 minutes devoted to eating, and 12 minutes spent resting after the meal. Smartphone use was pervasive throughout the restaurant visit. Specifically, 100% of the observed young diners ($n = 104$) used their phones while waiting for food, indicating a high prevalence of technology use during waiting times. During the meal, 98% ($n = 102$) used their smartphones, highlighting the integration of technology into the act of eating itself. Furthermore, 97% ($n = 101$) alternated between eating and phone use, suggesting a pattern of divided attention during the meal. Finally, 93% ($n = 97$) continued using their phones after finishing their meal, indicating that device engagement persisted beyond food consumption.

Figure 1 shows the percentages of time participants kept their phones put away, left them on the table, and actively used them during the pre-eating, eating, and post-eating periods. Before eating (Figure 1a), active smartphone use accounted for an average of 40% of the time, equivalent to 8.03 minutes. During this phase, devices were also frequently left on the table without active engagement (30% of the time, or 6.1 minutes), while being put away occurred for 29% of the time (5.9 minutes).

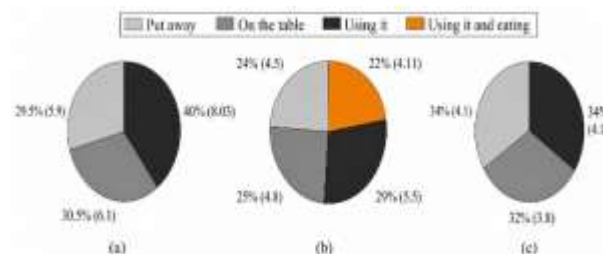


Figure 1. Percentages of time diners used, left on the table, and put away their phones at during the three moments: (a) before eating, (b) during eating, and (c) after eating.

During the meal itself (Figure 1b), diners exhibited intermittent engagement with their mobile phones. Active phone use while eating was observed for approximately 22% of the meal duration (4.11 minutes), and a further 29% of the time (5.5 minutes) involved alternation between eating and phone use, reflecting divided attention. In this phase, mobile phones remained on the table without active use for 25% of the time (4.8 minutes) and were put away for 24% of the time (4.5 minutes). In the post-eating phase (Figure 1c), mobile phone use

remained prevalent, accounting for 34% of the observed time (3.91 minutes). Similarly, phones were put away for 34% of the time (4.1 minutes) and left on the table without interaction for 32% of the time (3.8 minutes), suggesting continued awareness of the device even after meal consumption.

Overall smartphone engagement among youths in the restaurant setting was substantial. On average, young diners used their phones for 42.68% of their total time in the restaurant, corresponding to 21.74 minutes. By contrast, phones were kept put away for 28.46% of the observation period, equivalent to approximately 14.5 minutes, and were left on the table without active use for 28.85% of the time, representing an average of 14.7 minutes.

Hygiene

Regarding the number of diners who interacted with their smartphones, it was found that 93% used them while eating (Figure 2a). Of these, 71% (69 youths) did not clean their fingers between handling their phones and eating food (Figure 2b). This means that approximately 7 out of 10 diners who used their phones during the meal did not practice basic hygiene measures, raising significant concerns about the potential transmission of contaminants and bacteria during meals.

Spearman correlation analyses revealed statistically significant positive associations between smartphone manipulation during meals and the frequency of not cleaning hands or fingers afterward. The number of occasions in which diners manipulated the smartphone with one hand was positively associated with no-cleaning behavior ($\rho = 0.461$, $p < 0.001$), and this association was even stronger for manipulation with both hands ($\rho = 0.600$, $p < 0.001$).

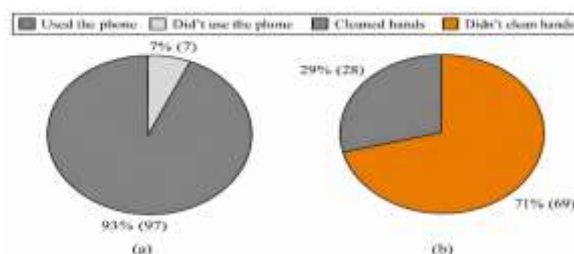


Figure 2. (a) Proportion of diners observed interacting and not interacting with their smartphones during their meal; (b) Distribution of hygiene practices among the subset of diners who interacted with both their smartphones and their food during the meal.

When both forms of manipulation were combined into a total smartphone-handling variable, a strong positive association was observed with no-cleaning behavior ($\rho = 0.769$, $p < 0.001$). By contrast, the association between total smartphone use time and no-cleaning behavior was weaker and did not reach statistical significance ($\rho = 0.187$, $p = 0.058$). These findings suggest that hygiene

lapses were more closely related to the frequency of phone handling during meals than to the total amount of time spent using the device (see Table 1).

Social interaction

The results regarding social interaction among diners, as depicted in Figure 3, illustrate varying levels of engagement. The study revealed that 3% of participants exhibited minimal to almost nonexistent conversational interaction. Sporadic conversations, often interrupted by smartphone use, were observed in 13% of the participants. However, a substantial majority of youths, specifically 84%, actively engaged in face-to-face interaction with their dining companions.

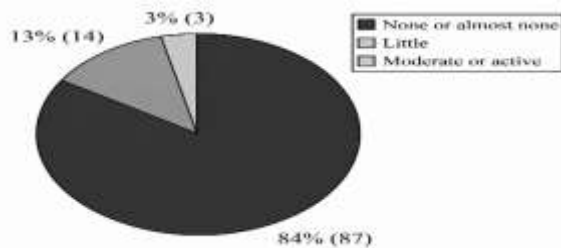


Figure 3. Distribution of different levels of engagement during the time they remained at the table.

To explore the relationship between total smartphone use time and level of social interaction, a Spearman correlation analysis was conducted. The results showed no statistically significant association between the two variables ($\rho = -0.046$, $p = 0.641$). Likewise, a Kruskal–

Wallis test found no significant differences in total smartphone use time across the three levels of social interaction ($H = 0.246$, $p = 0.884$). These findings suggest that, in this sample, the amount of time spent using the smartphone was not significantly associated with the observed level of social interaction (see Table 1).

Ways of holding the phone

Regarding the way diners interacted with their phones, Figure 4 shows that 48% placed the device on the table to touch the screen, while 40% held it with one hand and manipulated it with the other. Only 7% of diners used both hands to operate the device, and 4% alternated between holding and manipulating the smartphone with one hand. A small percentage, equivalent to 1%, used other handling patterns. These handling practices were further examined in the inferential analyses presented in Table 1, which showed that more frequent phone handling during meals was significantly associated with hygiene lapses.

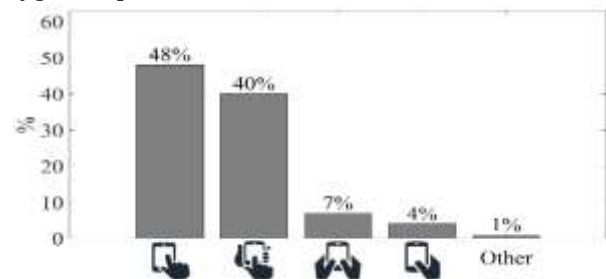


Figure 4. Predominant smartphone handling practices observed in the study.

Table 1. Inferential tests examining the association of smartphone use with hygiene lapses and social interaction.

Analysis	Variables compared	Statistical test	Coefficient / Statistic	p-value	Interpretation
1	Total smartphone use time vs. level of social interaction	Spearman correlation	$\rho = -0.046$	0.641	No statistically significant association
2	Total smartphone use time across the three levels of social interaction	Kruskal–Wallis test	$H = 0.246$	0.884	No statistically significant differences
3	One-hand smartphone manipulation vs. no-cleaning behavior	Spearman correlation	$\rho = 0.461$	< 0.001	Statistically significant positive association
4	Two-hand smartphone manipulation vs. no-cleaning behavior	Spearman correlation	$\rho = 0.600$	< 0.001	Statistically significant positive association
5	Total smartphone handling frequency vs. no-cleaning behavior	Spearman correlation	$\rho = 0.769$	< 0.001	Strong statistically significant positive association
6	Total smartphone use time vs. no-cleaning behavior	Spearman correlation	$\rho = 0.187$	0.058	Weak, non-significant association

Note. Social interaction was classified into three levels: 1 = minimal or no interaction, 2 = moderate interaction, and 3 = active interaction. No-cleaning behavior refers to the frequency with which diners handled the smartphone and subsequently failed to clean their hands or fingers before eating.

DISCUSSION

This study provides empirical evidence of the widespread integration of smartphone use during meals in fast-food restaurants among young people. All observed diners

used their mobile device at least once while seated at the table, a proportion that clearly exceeds what has been reported in similar studies conducted in other geographical contexts, as summarized in Table 2.

Table 2. Observed smartphone use among diners: international studies by population and usage rate.

Study	Country	People observed	Adolescents or Youths observed?	People who used the phone
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1	Radesky et al. (2014) [18]	USA	55	No	40 (73%)
2	Deloitte (2016) in [37]	USA	381	Yes	309 (81%)
3	Kellershohn et al. (2018) [32]	Canada	97	Yes	70 (72%)
4	Jayawickrama et al. (2020) [31]	Sri Lanka	189	Yes	89 (47%)
5	Kiefner et al. (2020) [20]	Italy	159	Yes	77 (48%)
6	Weber et al. (2020) [19]	Germany	503	Yes	270 (54%)
7	Elias et al. (2021) [22]	Israel	70	No	26 (37%)
8	Gale et al. (2023) [27]	USA	58 families	Yes	51 (88%)
9	de Paz et al. (2024) [30]	Spain	1616	Yes	454 (28%)

Compared to previous research, our findings reveal a markedly higher rate of smartphone use. For instance, Kellershohn et al. [32] reported a 72% usage rate among young diners in Canada, while Weber et al. [19] found a rate of 54% in Germany. Although both studies also focused on adolescents and young adults, their reported rates were considerably lower than those observed here. Gale et al. [27] documented an 88% usage rate in a study involving families in the United States, which represents the closest figure to our findings. However, in that study the family, rather than the individual diner, was used as the unit of observation, which may limit direct comparability.

These differences may be explained by contextual factors. Unlike other settings described in the literature, the restaurant selected for this study offered free Wi-Fi access, a condition previously identified as encouraging smartphone use in social environments [3, 19]. In addition, our sample consisted exclusively of individuals aged 12 to 30 years, a demographic widely recognized for its high technological dependence and its tendency to integrate mobile phone use into everyday routines, including mealtimes [35]. The convergence of a digitally connected youth population and the immediate availability of internet access may jointly explain the elevated smartphone use observed in this study.

On the other hand, studies such as those by Jayawickrama et al. [31] in Sri Lanka and Kiefner-Burmeister et al. [20] in Italy reported lower levels of smartphone use, ranging from 47% to 48%. Such variation may reflect cultural differences, unequal access to technology, or different parenting strategies regarding smartphone use in family and social contexts. Likewise, studies focused on children, such as those by Elias et al. [22] and de Paz-Cantos et al. [30], documented even lower rates, 37% and 28%, respectively. This reinforces the importance of considering age as a central factor when analyzing smartphone-related behavior during meals.

A major contribution of this study lies in the structured and unobtrusive documentation of three dimensions simultaneously: smartphone use, hygiene practices, and social interaction. Unlike previous studies that addressed only one or two of these dimensions—such as those summarized in Table 1, none of which considered hygiene—or studies based on self-reported data [16, 19, 36], our research analyzed smartphone use across three distinct phases of the meal: before eating, during the

meal, and after eating. This approach made it possible to observe more precisely how diners interacted with their devices and how those interactions related to hygiene and social behavior. Only Weber et al. [19] and de Paz-Cantos et al. [30] applied a partially comparable framework. In contrast, other studies, including those by Radesky et al. [18], Kiefner-Burmeister et al. [20], Jayawickrama et al. [31], and Gale et al. [27], focused on overall smartphone use without distinguishing specific phases of the meal. In this sense, the methodological approach of the present study advances the analysis of everyday behavior in dining contexts, especially in fast-food settings.

Regarding hygiene, the study found that 71% of the young diners did not clean their hands after handling their phone and before consuming food. This is a relevant finding, given that smartphones are recognized as potential vectors of microbial transmission [9, 10, 14]. Our results are consistent with previous warnings about the risks involved in the hand–phone–food–mouth sequence [12, 15], and they strengthen the argument that current hygiene education should take into account the routine incorporation of mobile devices into eating practices.

Inferential analysis further reinforced this pattern. More frequent smartphone manipulation during meals was significantly associated with hygiene lapses. Specifically, one-handed phone manipulation was positively associated with no-cleaning behavior, and this relationship became even stronger when the device was manipulated with both hands. When both forms of manipulation were combined into a single indicator of smartphone-handling frequency, the association with no-cleaning behavior was strong and statistically significant. By contrast, total smartphone use time was only weakly associated with no-cleaning behavior and did not reach statistical significance. Taken together, these results suggest that hygiene risk is linked more closely to repeated phone handling during meals than to duration of use alone. This distinction is important, as it indicates that contamination risk may depend less on how long the device is used and more on how often it is physically handled while food is being consumed.

Unlike laboratory-based or experimental studies on contamination [11, 12, 15], the present research documents actual behaviors in a natural setting. This gives the findings particular diagnostic value, as they

reflect how hygiene lapses occur under ordinary conditions rather than under controlled observation.

In terms of social interaction, the descriptive results showed that smartphone use did not entirely eliminate face-to-face communication among diners. Only 16% of participants displayed minimal or no interaction, while most maintained moderate or active communication with their companions. This suggests that, despite the constant presence of smartphones, in-person engagement remains an important part of the shared dining experience among young people.

However, inferential analysis did not reveal a statistically significant association between total smartphone use time and level of social interaction. Neither the Spearman correlation nor the Kruskal–Wallis test detected meaningful differences between the amount of time spent using the smartphone and the observed interaction categories. This suggests that, in this sample, the total duration of smartphone use was not significantly associated with the level of social interaction. Even so, this finding should be interpreted cautiously because the distribution of cases across interaction categories was clearly uneven, particularly the very small number of diners classified as having minimal or no interaction.

These results nuance conclusions from previous studies such as Deloitte [37], which reported an 87% reduction in social interaction attributed to smartphone use. At the same time, our findings partially align with those of Allred and Atkin [7], Jayawickrama et al. [31], and Elias et al. [22], who also reported only marginal effects on face-to-face communication. This discrepancy across studies may be explained by differences in observation context, age of participants, or the type of social bond among diners. In our study, many interactions appeared to occur among friends or peers rather than within formal family settings, which may help explain why social exchanges persisted despite frequent device use.

By contrast, other studies—such as those by Alwi et al. [24], de Paz-Cantos et al. [30], and Obrist et al. [17]—have documented more pronounced negative effects, particularly among children or in school-related environments. This suggests that the effects of smartphone use on interaction are context-sensitive and may depend heavily on the social setting in which device use takes place.

Among the main strengths of this study is the use of a non-invasive observational technique, which allowed the documentation of natural behavior without altering participants' conduct. The clear delimitation of meal phases, the triangulation of hygiene and interaction indicators, and the focus on young diners in a realistic setting all strengthen the analytical contribution of the study.

Nevertheless, several limitations should be acknowledged. First, the sample was neither probabilistic nor representative, which limits the generalizability of the findings. Second, demographic variables such as age and gender were estimated visually rather than measured directly, which may reduce precision. Third, the findings

are restricted to a specific type of restaurant in which food is typically eaten by hand rather than with cutlery, a condition that may have amplified the hygiene-related results. Finally, the social interaction categories were unevenly distributed, which may have reduced the ability of inferential tests to detect significant differences.

Regarding transferability, the findings are particularly relevant for urban contexts in Latin America where fast-food dining, free internet access in commercial settings, and high smartphone penetration among youth are common. However, caution is needed when extrapolating these findings to rural areas or to countries with different technological, cultural, or dining patterns.

In terms of future research, qualitative studies could help clarify the meanings young people attribute to smartphone use during meals and the reasons why they maintain or interrupt face-to-face interaction while using their devices. It would also be useful to compare these behaviors across different restaurant types and social contexts in order to identify situational differences. Longitudinal approaches could further illuminate how these habits evolve over time.

From a practical perspective, the findings support the need for interventions aimed at improving digital hygiene during meals. Awareness campaigns in restaurants, educational initiatives targeting young consumers, and subtle environmental strategies may help promote healthier practices without relying on restrictive rules. In particular, the inferential results suggest that interventions should focus not only on reducing total screen time at the table but also on discouraging repeated handling of smartphones while eating.

Finally, no major ethical dilemmas were identified during the implementation of the study. Nevertheless, the ethical challenge of observing behavior without direct informed consent from participants must be acknowledged. To minimize this concern, privacy was protected, no personal identifiers were collected, and authorization was obtained from the establishment's owner in accordance with ethical guidelines for unobtrusive observational studies [34].

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References

- [1] M. C. Cheung, J. S. K. Lai, and J. Yip, "Influences of Smartphone and Computer Use on Health-Related Quality of Life of Early Adolescents," *Int J Environ Res Public Health*, vol. 19, no. 4, 2022, doi: 10.3390/ijerph19042100.
- [2] Z. A. Ratan, A. M. Parrish, S. Bin Zaman, M. S. Alotaibi, and H. Hosseinzadeh, "Smartphone addiction and associated health outcomes in adult

- populations: A systematic review,” 2021. doi: 10.3390/ijerph182212257.
- [3] M. Olivella-Cirici, X. Garcia-Continente, M. Bartoli Checa, G. Serral Cano, and G. Pérez Albarracín, “The problematic use of the mobile phone: cross-sectional analysis of the individual profile and associated factors,” *Rev Esp Salud Publica*, vol. 97, 2023.
 - [4] Y. Wacks and A. M. Weinstein, “Excessive Smartphone Use Is Associated With Health Problems in Adolescents and Young Adults,” 2021. doi: 10.3389/fpsy.2021.669042.
 - [5] R. F. da M. Gonçalves *et al.*, “Smartphone use while eating increases caloric ingestion,” *Physiol Behav*, vol. 204, 2019, doi: 10.1016/j.physbeh.2019.02.021.
 - [6] M. La Marra, G. Caviglia, and R. Perrella, “Using Smartphones When Eating Increases Caloric Intake in Young People: An Overview of the Literature,” 2020. doi: 10.3389/fpsyg.2020.587886.
 - [7] R. J. Allred and D. Atkin, “Cell Phone Addiction, Anxiety, and Willingness to Communicate in Face-to-Face Encounters,” *Communication Reports*, vol. 33, no. 3, 2020, doi: 10.1080/08934215.2020.1780456.
 - [8] S. L. Lian, X. J. Sun, G. F. Niu, X. J. Yang, Z. K. Zhou, and C. Yang, “Mobile phone addiction and psychological distress among Chinese adolescents: The mediating role of rumination and moderating role of the capacity to be alone,” *J Affect Disord*, vol. 279, 2021, doi: 10.1016/j.jad.2020.10.005.
 - [9] M. Olsen *et al.*, “Mobile phones represent a pathway for microbial transmission: A scoping review,” 2020. doi: 10.1016/j.tmaid.2020.101704.
 - [10] N. A. Hikmah and T. S. Anuar, “Mobile phones: A possible vehicle of bacterial transmission in a higher learning institution in Malaysia,” *Malaysian Journal of Medical Sciences*, vol. 27, no. 2, 2020, doi: 10.21315/mjms2020.27.2.15.
 - [11] N. Bhardwaj, M. Khatri, S. K. Bhardwaj, C. Sonne, A. Deep, and K. H. Kim, “A review on mobile phones as bacterial reservoirs in healthcare environments and potential device decontamination approaches,” 2020. doi: 10.1016/j.envres.2020.109569.
 - [12] W. Gómez-Gonzales *et al.*, “Contamination by Antibiotic-Resistant Bacteria on Cell Phones of Vendors in a Peruvian Market,” *Medicina (Lithuania)*, vol. 59, no. 4, 2023, doi: 10.3390/medicina59040669.
 - [13] M. Kirchner, R. M. Goulter, B. J. Chapman, J. Clayton, and L. A. Jaykus, “Cross-contamination on atypical surfaces and venues in food service environments,” 2021. doi: 10.4315/JFP-20-314.
 - [14] M. Olsen *et al.*, “Mobile phones are hazardous microbial platforms warranting robust public health and biosecurity protocols,” *Sci Rep*, vol. 12, no. 1, 2022, doi: 10.1038/s41598-022-14118-9.
 - [15] L. Tajouri *et al.*, “The role of mobile phones as a possible pathway for pathogen movement A cross-sectional, microbial analysis,” *Travel Med Infect Dis*, vol. 43, 2021, doi: 10.1016/j.tmaid.2021.102095.
 - [16] S. Bhandari, “Mindful Interactions,” 2019.
 - [17] F. ‘Floyd’ Mueller *et al.*, “Grand challenges in human-food interaction,” *International Journal of Human Computer Studies*, vol. 183, 2024, doi: 10.1016/j.ijhcs.2023.103197.
 - [18] J. S. Radesky *et al.*, “Patterns of mobile device use by caregivers and children during meals in fast food restaurants,” *Pediatrics*, vol. 133, no. 4, 2014, doi: 10.1542/peds.2013-3703.
 - [19] P. Weber, P. Engelbutzeder, and T. Ludwig, “‘always on the Table’: Revealing Smartphone Usages in everyday Eating Out Situations,” in *ACM International Conference Proceeding Series*, 2020. doi: 10.1145/3419249.3420150.
 - [20] A. Kiefner-Burmeister, S. Domoff, and J. Radesky, “Feeding in the digital age: An observational analysis of mobile device use during family meals at fast food restaurants in Italy,” *Int J Environ Res Public Health*, vol. 17, no. 17, 2020, doi: 10.3390/ijerph17176077.
 - [21] J. M. Soon, “Finger licking good? An observational study of hand hygiene practices of fast food restaurant employees and consumers,” *British Food Journal*, vol. 121, no. 3, 2019, doi: 10.1108/BFJ-07-2018-0420.
 - [22] N. Elias, D. Lemish, and G. Rovner-Lev, “Food for Thought: Parent-Child Face-to-Face Communication and Mobile Phone Use in Eateries,” *J Fam Commun*, vol. 21, no. 4, 2021, doi: 10.1080/15267431.2021.1953501.
 - [23] R. Pérez-Sánchez and M. Dodel, “Predictores del uso problemático del teléfono celular en adolescentes costarricenses,” *Revista Latinoamericana de Ciencias Sociales, Niñez y Juventud*, vol. 21, no. 1, 2025, doi: 10.11600/rlcsnj.21.1.5525.
 - [24] M. F. Alwi, S. Adi, and W. C. Rachmawati, “The Effect of Smartphone Addiction on Adolescent Mental Health and Social Interaction,” in *Proceedings of the 5th International Conference on Sport Science and Health (ICSSH 2021)*, 2022. doi: 10.2991/ahsr.k.220203.012.
 - [25] L. Lin, X. Wang, Q. Li, B. Xia, P. Chen, and W. Wang, “The Influence of Interpersonal Sensitivity on Smartphone Addiction: A Moderated Mediation Model,” *Front Psychol*, vol. 12, 2021, doi: 10.3389/fpsyg.2021.670223.
 - [26] B. Mostyn Sullivan, A. M. George, and D. Rickwood, “An exploration of motives that influence problematic smartphone use in young adults,” *Behaviour and Information Technology*, vol. 44, no. 9, 2025, doi: 10.1080/0144929X.2024.2380102.

- [27] M. Gale, J. Shawcroft, S. M. Coyne, S. Brown, and J. Radesky, "McDonalds, Mom, Media, and Me: An Observational Study of Parent and Adolescent Media Use During Public Family Mealtime," *Transl Issues Psychol Sci*, vol. 9, no. 3, 2023, doi: 10.1037/tps0000368.
- [28] M. Kikumori and R. Ishii, "Dine with me, not your smartphone! Negative impacts of companion phubbing on dining experience satisfaction," *Consumer Behavior in Tourism and Hospitality*, vol. 20, no. 1, 2025, doi: 10.1108/CBTH-07-2024-0250.
- [29] A. M. Lando, M. C. Bazaco, and Y. Chen, "Consumers' use of personal electronic devices in the kitchen," *J Food Prot*, vol. 81, no. 3, 2018, doi: 10.4315/0362-028X.JFP-17-172.
- [30] S. de Paz-Cantos *et al.*, "Smartphone use by children in fast food restaurants in Barcelona (Spain): a direct observation study," *Gac Sanit*, vol. 38, 2024, doi: 10.1016/j.gaceta.2024.102421.
- [31] J. G. K. C. Jayawickrama, S. Selvam, T. M. Dunumala, Y. A. M. S. Samaratunga, H. W. M. C. Weligodapola, and R. M. N. M. Rathnayake, "Fast Food Consumption Behavior among Young Parents: A Qualitative Study with Special Reference to Selected Franchised Fast Food Restaurants Within the Colombo City in Sri Lanka," *International Journal of Academic Research in Business and Social Sciences*, vol. 10, no. 4, 2020, doi: 10.6007/ijarbss/v10-i4/7202.
- [32] J. Kellershohn, K. Walley, B. West, and F. Vriesekoop, "Young consumers in fast food restaurants: technology, toys and family time," *Young Consumers*, vol. 19, no. 1, 2018, doi: 10.1108/YC-08-2017-00731.
- [33] Statista, "Share of adults in the United States who owned a smartphone from 2015 to 2023, by age group," <https://www.statista.com/statistics/489255/percent-age-of-us-smartphone-owners-by-age-group/>.
- [34] I. Karunarathna *et al.*, "Data Collection Fundamentals: A Guide to Effective Research Methodologies and Ethical Practices," Research Gate.
- [35] E. Y. K. Ng, L. N. Ung, F. C. Ng, and L. S. J. Sim, "Statistical analysis of healthy and malignant breast thermography," *J Med Eng Technol*, vol. 25, no. 6, 2001, doi: 10.1080/03091900110086642.
- [36] H. Davis, H. S. Ferdous, and F. Vetere, "Table manners': Children's use of mobile technologies in family-friendly restaurants," in *Conference on Human Factors in Computing Systems - Proceedings*, 2017, doi: 10.1145/3027063.3053353.
- [37] "Deloitte-Mobile-Consumer-2016-There-is-no-place-like-phone".

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