

SYSTEMATIC REVIEW

The Effect of Eating Alone and Eating with Familiar or Unfamiliar Others on Food Intake: A Systematic Review

Noraishah Mohamed Nor, Nurul Khaleda Mohd Nasir, Nor Azwani Mohd Shukri

Department of Nutrition Sciences, Kulliyah of Allied Health Sciences, International Islamic University Malaysia, 25200 Kuantan, Pahang, Malaysia

ABSTRACT

Aims and Design: Individuals' food intake may vary depending on their situation and with whom they are having their meal. Thus this systematic review aimed to compare the effect of social facilitation between eating alone and eating with others, and evaluate the social modeling effect when eating with familiar or unfamiliar others, on food intake. **Data Sources:** Articles were screened and reviewed based on titles, abstracts and keywords. Inclusion criteria included experimental design, English language, open-accessed, and published from 1980 until the review was conducted in 2018. **Review Methods:** Using the PRISMA method, potential studies were identified on Science Direct, ProQuest, PubMed, Scopus, and BASE databases using two different keywords combinations. **Results:** Seventeen studies were included. For social facilitation, seven studies found that food intake increases when eating alone while five others stated it would increase when eating with others. One study suggested that it increases in both situations. For social modeling of food intake, two studies found that it commonly occurs when an individual eats in the presence of unfamiliar others, while one study reported that it happens more often with familiar others. Two other studies observed that social modeling occurs in both situations. **Conclusion and Impact:** Food intake tends to increase when eating alone than eating with others while the presence of familiar or unfamiliar others may either increase or limit an individual's food consumption to socially match their co-eaters' intake. Thus, good self-control is crucial for setting a dietary limit regardless of whether ones are eating alone or with familiar or unfamiliar others.

Malaysian Journal of Medicine and Health Sciences (2023) 19(1):272-279. doi:10.47836/mjmhs19.1.35

Keywords: Eating alone, Eating with familiar others, Eating with unfamiliar others, Social modeling, Social facilitation

Corresponding Author:

Nor Azwani Mohd Shukri, PhD
Email: norazwani@iiu.edu.my
Tel: +609-5705307

INTRODUCTION

People's behaviour may change depending on the situation and with whom they interact. Similarly, one's food intake may vary depending on their situation and with whom they are having their meal. This may affect one's nutritional intake. For instance, according to Chae and colleagues (2018), participants who eat alone (solitary eating) tend to experience nutrient deficiency compared to those who eat with a companion (1).

Food intake can be defined as consuming any substance containing carbohydrates, protein, fat, vitamins, and minerals (2). In this study, food intake focuses more on the amount of food eaten rather than the type of food chosen. Many factors can affect one's food intake, leading to overindulgence or restraint. Overindulgence or overeating happens when an individual's dietary intake exceeds the recommended amount (3). Overindulgence

may not be problematic if it only occurs occasionally. However, for some individuals, this could become a habit that may always happen in any situation. Besides physical inactivity, overeating is a common cause of obesity (4), increasing the risk of non-communicable diseases such as type 2 diabetes mellitus, high blood pressure, and cardiovascular diseases (5). Biological, physical, social, psychological, and situational factors may affect an individual's food intake (6).

The social facilitation theory was introduced in 1898 by Norman Triplett (7). It describes that people would act inversely when they are with others than they would when they are alone, where they tend to perform better when (they think) others are monitoring them (7). Eating alone may refer to eating in a space without the presence of anyone else or eating alone in public. Meanwhile, eating with others can be categorized into eating with familiar others (family members, friends, partners, or co-workers) or unfamiliar others (strangers) (5).

According to Albert Bandura, social modeling generally refers to an individual's observation of others' behaviour and imitation of that behaviour (8). The social modeling

of food intake, also known as ‘social matching’, occurs when one replicates the amount of food consumed by their eating partner (9). For example, when an individual eats less, their dining partner would also eat less, and vice-versa.

Social facilitation and social modeling have been demonstrated to affect food intake. Thus, this study intended to document the evidence of whether eating alone or eating with others, and whether eating with familiar or unfamiliar others, would increase one’s food intake. Understanding the situations that could affect their food intake would be beneficial as individuals could be more mindful about their eating behaviours. For instance, they could set a limit on how much they should be eating which could help in preventing overeating.

METHODS

Study identification & selection

A systematic review was conducted using the PRISMA checklist as a guide (10). The databases used to collect the data included Science Direct, ProQuest, PubMed, Scopus, and BASE. The keywords used were ‘eating alone’, ‘eating with others’, ‘eating without a companion’, ‘eating with a companion’, ‘social facilitation’, ‘social modeling’, ‘social matching’, ‘food intake’, ‘food consumption’, ‘meal intake’ and ‘meal consumption. Boolean operators (AND, OR and NOT) were also used in connecting the keywords to broaden the search. The search process was conducted from September until December 2018. The inclusion and exclusion criteria are shown in Table I.

Data extraction

The data that were extracted from the included study comprised the aim of the study, publication year, setting of the studies, sample size, study design, information of the subjects/participants (age, gender, weight status), model’s information (weight status, familiarity), detailed description of the study procedure (i.e., duration of the experiment), measurement (food use in the experiment), and main outcome (in this study, the main interest was on food intake and social matching).

Risk of bias assessment

Cochrane’s guideline was used to assess the risk of bias for the included studies. There were seven domains: 1) Random sequence generation; 2) Allocation concealment; 3) Blinding of participants and personnel; 4) Blinding of outcome assessment; 5) Incomplete outcome data; 6) Selective reporting; 7) Other bias. The judgment for every domain was classed into low risk, high risk, and unclear risk.

Summary measures

The primary outcome measure for the first part, which

Table I: Criteria for inclusion and exclusion for the article reviewed

No.	Inclusion Criteria	Exclusion Criteria
1.	Based on original research / experimental studies	Not based on original research (i.e., editorial, case report, brief report, commentary, qualitative, self-perception, and observational studies)
2.	Published in English language	Published in languages other than English
3.	Published between 1980 and 2018	
4.	Accessible in full text	

is the situation that leads to increased food intake (alone or with others) was the mean difference in food consumption (in grams or energy) between eating alone and eating in groups. Meanwhile, the primary outcome for the evidence of social modeling on food intake between eating with familiar others and with unfamiliar others was the intraclass correlation coefficient (ICC). A high ICC value indicates high social modeling of food intake which occurs when an individual closely follows the food amount of their eating partner (11).

Data analysis and synthesis of results

The studies were analyzed to identify the social facilitation that leads to increased food intake (alone or with others) and to evaluate the social modeling effect when eating with familiar and unfamiliar others. A narrative synthesis was performed since the measurements used in the included studies were not uniform.

RESULTS

Study selection

Fig. 1 describes each process of the study selection for this systematic review.

Study characteristics

The characteristics extracted from each article included the authors, year published, study design, settings, descriptions of both participants and model, and detailed description of procedure, and outcome measures, which are presented in Table II. All the reviewed studies were level two evidence and used experimental study design. Only studies that used live models were included in this review.

The study settings included primary and high schools, hospitals, universities, and research centres. One study was included even though it was published slightly earlier than the inclusion criteria for this review because it was deemed relevant to answer the review question. Besides, it met all the other inclusion criteria. Some studies included both genders, while others only included female or male participants. The participant’s body mass index (BMI) status varied either normal or a combination of normal, overweight, and obese. As for the age of the participants, some studies were conducted on a specific age group while others were not.

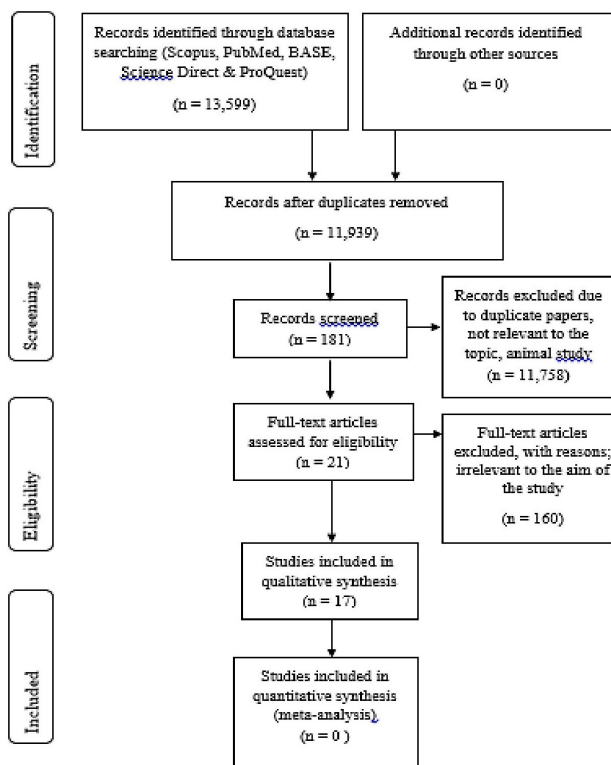


Figure 1: Flow diagram for the review adapted from PRISMA (6)

Risk of bias assessment

Table III shows the risk of bias for individual studies. All the included studies showed a low risk of bias for the selective reporting (reporting bias) domain. However, there was a high risk of bias across the studies for blinding participants and selection bias. As for the unclear risk of bias, it could not be identified in terms of blinding of participants and personnel (performance bias), blinding of outcome assessment (detection bias) and selective reporting (reporting bias).

Social facilitation

A total of 7 studies concluded that eating alone would increase food intake compared to eating with others (3,12–17). These studies showed that the presence of others could inhibit one's food intake regardless of whether it is a non-eating, low intake, or high intake eating partner. This might be why people would increase their food intake when eating alone compared to eating with others. The increased food intake when eating alone was also suggested to be due to individuals' age (16). This was evidenced by the findings of one particular study, where the effect of "social inhibition" as opposed to "social facilitation" previously shown in adults, was demonstrated among their teenage research participants. They concluded that teenagers do not increase their food intake in response to the presence of distractors such as

Table II: Study characteristics and evidence table of included studies

Author (s), (Year), Country	Study Design; Sample Size; Age Group	Types of Modelling Strategies	Outcome Parameters	Results	Summary of Findings
Bevelander et al. (2012); Netherlands (12)	Experimental; 223; 6-11 (primary school children)	Unfamiliar with each other	The total amount of food intake in kilocalories	On average, participants took 41.11 bites (SD=13.34), whereas instructed co-eaters took an average of 30.13 bites (SD=12.98) during the 20-minute eating occasion	This study suggests that behavioural mimicry may partially account for social modelling of food intake
Bellisle et al. (2009); France (3)	Experimental; 40; 20-30 (young adult)	Unfamiliar with each other	Energy intake during lunch hours subjects ate alone; in groups; listening to a detective story on the radio; watching television (no food cues); watching food advertisements on television	Repeated measures ANOVAs revealed no significant main effect of level of restraint and no interaction with meal conditions.	The results suggest that the intake stimulating effects of various external sources of distraction at mealtime could vary in different populations
Clendenen (1994); Canada (19)	Experimental; 120; 18-30 (young adults)	Unfamiliar with each other and familiar (friends)	Energy Intake during dinner Subjects dined alone; in pair; or in a group of four	Subject ate with friends eat more desserts compared to alone and group with strangers	The relationship of dining partners is an important component contributing to the extra intake
Edelman et al. (1986); USA (20)	Experimental; 53; 34 (adults)	Familiar (friends)	Portion size between normal weight and overweight men	Overweight subjects ate more than normal-weight subjects, and both overweight and normal-weight subjects ate more in groups than subjects eating alone	There are differences in intake between overweight and normal-weight individuals and the potential importance of environmental factors in the total intake.
Hetherington et al. (2006) (21)	Experimental; 37; 18-54 (adults)	Unfamiliar with each other and familiar (friends)	Energy intake (EI) and duration of eating • Eating alone; Eating in the presence of a television; Eating with unfamiliar others and Eating with familiar others (friend)	<ul style="list-style-type: none"> • EI was significantly enhanced by the presence of familiar and watching TV • Length of eating episode correlated significantly with EI, • Eating with friends increased EI by 18%, and eating in front of the TV increased EI by 14%. 	Food intake can be enhanced when attention to food and self-monitoring are impaired during the distraction; however, this effect is moderated when eating with strangers.
Vartanian et al. (2013); Australia (13)	Experimental; 94; 17-26 (young adults)	Unfamiliar with each other	Total EI and influencing factors Assigned to three groups with different conditions, which are low-intake model; high-intake model; control condition	<ul style="list-style-type: none"> • Participants in the low-intake conditions ate less than participants in the high-intake conditions. • A lower perceived norm of appropriate intake participants was much more likely to indicate that their food intake was influenced by taste and hunger than by the behaviour of the social models 	The social models appear to affect food intake by providing a norm of appropriate eating behaviour, but people may be unaware of the influence of a social model on their behaviour

Table II: Study characteristics and evidence table of included studies (Continued)

Author (s), (Year), Country	Study Design; Sample Size; Age Group	Types of Modelling Strategies	Outcome Parameters	Results	Summary of Findings
Mekhmoukh et al. (2012); France (2)	Experimental; 40; 15-17 (adolescent)	Familiar (friends)	Total EI between normal weight and overweight male Eating in groups; Eating alone; Eating alone while viewing television; Eating alone while listening to music.	<ul style="list-style-type: none"> Normal-weight participants ate more solids while listening to music than when eating alone or in groups Overweight participants ate more solid foods while viewing television than when eating in groups or while listening to music 	Environmental conditions modulate total energy intake at lunch in adolescents, and susceptibility to external factors can be affected by weight status.
Péneau et al. (2009); France (16)	Experimental; 33; 15-16 (adolescent)	Not mention	Total EI, pre-and post-meal hunger and thirst and meal palatability during lunch Subjects ate alone; in groups; alone while viewing television; alone while listening to music	<ul style="list-style-type: none"> Intake was different (significantly lower) only in the eating in the group condition, with the identical intensity of pre-meal hunger More soda was consumed when participants were watching television, and more water was consumed while listening to music In teenagers, the 'social inhibition' effect appears rather than the 'social facilitation'. 	The social significance of meal conditioned responses and habituation to 'distractors' may differ between adolescents and adults.
Pliner et al. (2006); US (14)	Experimental; 132; 22-66 (adults)	Familiar (friends)	Amount of food consumed Different gender, group sizes and duration	<ul style="list-style-type: none"> Male participants ate more than females, Participants exposed to longer meal time eat more than those in shorter meal time. The effect of group size was not significant The amounts consumed by participants eating in two-person groups resembled one another more than a participant who ate alone or participants in groups of four. 	The effect of group size and amount of intake is mediated by meal duration.
Polman et al. (2018); Netherlands (15)	Experimental; 64; 17-26 (young adults)	Unfamiliar with each other	Amount of food intake Eating with a stranger all the way; Eating with a stranger halfway then continue eating alone	<ul style="list-style-type: none"> Participants who were left alone increased their intake on average Participants who remained with the non-eating stranger did not increase intake 	Intake behaviours are too extreme and divergent from the desire to eat as much as possible; women may, on average, only adhere to these behaviours in the presence of others.
Rosenthal & Marx (1979), USA (22)	Experimental; 81; 18-56 (adults)	Unfamiliar with each other	Amount of food eaten Successful dieters; Unsuccessful dieters and control group	<ul style="list-style-type: none"> Subjects who ate with an appropriate model or with no model ate fewer crackers than subjects who ate with an inappropriate model. Subjects in both dieter groups ate fewer crackers than non-dietering normal-weight subjects. 	Subjects' current eating behaviour has more influence on food intake than social facilitation.
Salvy et al. (2008) (17)	Experimental; 44; 5-11 (children)	Unfamiliar with each other and familiar (siblings)	Total EI Eating alone, with a sibling or with an unfamiliar peer	<ul style="list-style-type: none"> The social condition was related to the participants' energy intake. Children eating with their siblings ate more cookies than children eating with strangers or eating alone. 	The matching effect is not pervasive, and that familiarity affects the level of matching of eating in children.
Salvy, S. J., et al. (2008) (18)	Experimental; 39; 10-12 (children)	Unfamiliar with each other	Total EI and food choices <ul style="list-style-type: none"> Eating alone or in group overweight participants paired with lean participants and vice versa.	<ul style="list-style-type: none"> Overweight children ate more when alone than when in a peer's presence and more when alone than the lean children in the same condition. Non-overweight children food intake was unaffected by the social context. Participants consumed healthy snack foods as if the pair also consumed healthy snack foods. 	The presence of peers can influence overweight children's energy intake and also affect healthier food selection in both overweight and non-overweight children
Salvy, S.J., et al. (2007) (24)	Experimental; 32 ; 6-10 (children)	Unfamiliar with each other	Total Food Intake (overweight vs normal weight) Eating alone or in pairs	<ul style="list-style-type: none"> The random regression model indicated that overweight children ate more when with others than when alone. Normal-weight children ate more with others than they did when alone. 	The social environment is different between overweight and non-overweight children. Thus, social involvement may be an important tool in treatment and prevention programs for overweight and obesity.
Kaisari, P. and S. Higgs (2015); The UK (26)	Experimental; 110; Mean age 18 (adolescent)	Unfamiliar with each other and familiar (friends)	Total food intake and food choices Eating with familiar others; eating with unfamiliar other	<ul style="list-style-type: none"> Female pairs completed a task together whilst having access to high energy-dense foods. Modelling was observed regardless of the familiarity of the dining partners and food types consumed 	Social modelling of food intake is a robust phenomenon that occurs even among familiar dining partners and when partners consume different snack food types.

Table II: Study characteristics and evidence table of included studies (Continued)

Author (s), (Year), Country	Study Design; Sample Size; Age Group	Types of Modelling Strategies	Outcome Parameters	Results	Summary of Findings
Salvy, S. J., et al. (2009) (25)	Experimental; 72; 9-15 (Children)	Unfamiliar with each other and familiar (friends)	Total EI (nutrient-dense or energy-dense) among overweight and non-overweight children Eating with familiar others or unfamiliar others.	<ul style="list-style-type: none"> Participants eating with a friend ate substantially more than participants eating with an unfamiliar peer. Overweight children who ate with an overweight partner (friend or unfamiliar peer) consumed more food than overweight participants who ate with a non-overweight eating partner. Matching of intake was greater between friends than between unfamiliar peers. 	The partners' weight statuses may add to the facilitative effect of familiarity and result in greater energy intake in overweight youth and their friends.
Salvy, S. J., et al. (2007) (23)	Experimental; 310; 19-21 (young adult)	Unfamiliar with each other and familiar (friends, romantic partner)	Average food intake Eating with opposite-sex romantic partners; Eating with opposite-sex strangers; Eating with female friends; Eating with female strangers; Eating with male friends and eating with male strangers.	<ul style="list-style-type: none"> The familiarity between co-eaters and the participants' gender predicted food consumption. The unfamiliarity suppressed both men's and women's food intakes The matching effect operated only when a female co-eater was involved. 	In some social contexts, self-enhancing intentions can be served by restricting intake and coaxing attitude or behavioural conformity strategies

Table III: Risk of bias for individual studies

Author (s), (Year), Country	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (Detection bias)	Incomplete outcome data addressed (attrition bias)	Selective reporting (reporting bias)	Other bias
Bevelander, K. E., et al. 2012 (12)	-	?	-	+	?	+	?
Bellisle, F., et al. 2009 (3)	-	?	-	+	+	+	-
Clendenen, V. L. 1994 (19)	+	?	-	-	?	+	?
Edelman, B., et al. 1986 (20)	?	?	-	+	-	+	?
Hetherington, M. M., et al. 2006 (21)	-	?	-	-	+	+	?
Lenny, R. V., et al. 2013 (13)	+	?	-	+	+	+	?
Mekhmoukh, A., et al. 2012 (2)	+	-	-	+	+	+	?
Peneau, S., et al. 2009 (16)	+	-	-	+	+	+	?
Pliner, P., et al. 2006 (14)	+	-	-	+	+	+	?
Polman, M. A. A., et al. 2018 (15)	?	?	-	+	+	+	?
Rosenthal, B. and R. D. Marx 1979 (22)	+	+	-	+	?	+	?
Salvy, S. J., et al. 2008 (17)	-	-	-	+	+	+	?
Salvy, S. J., et al. 2008 (18)	-	-	-	+	+	+	?
Salvy, S.J., et al. 2007 (24)	-	-	-	+	+	+	?
Kaisari, P. and S. Higgs 2015 (26)	-	-	-	+	-	+	?
Salvy, S. J., et al. 2009 (25)	+	-	-	+	+	+	?
Salvy, S. J., et al. 2007 (23)	+	+	-	+	?	+	?

(+:) Low risk of bias

(?): Unclear risk of bias

(-): High risk of bias

television or music, as previously reported in adults (2). On the other hand, an individual's body weight status may also play a role in social facilitation. Overweight persons were reported to have a higher food intake when eating alone than when they did so with others because they were aware of body weight stigmatization and social approval (18).

Five studies agreed that eating with others would increase one's food intake compared to eating alone (17,19–22). In one study, the participants were divided into two groups; the isolated group in which the individuals were asked to eat alone, and the social condition group, where three to four subjects were gathered to eat together (23). Similar to the findings

of others (21,24), it was demonstrated that distraction causes subjects in the social condition group to eat more compared to the participants in the isolated group (22). Conversation between the participants causes them to be distracted and stay longer in front of the food. Indeed, a time extension can also be a reason for people to eat more when with others (19,21).

Studies have shown that familiarity plays a role in social facilitation where individuals would increase their intake when they eat with their siblings, friends, or someone they were familiar with (17,19,21). A study noted that people would give less attention to their meals when dining with familiar others and increase their intake without realizing it, regardless of distraction (21). This study involved four sessions; solo eating, eating in the presence of television, eating with unfamiliar others, and eating with familiar others (21). While study participants who were eating with familiar others showed increased intake compared to eating alone, eating with unfamiliar others did not produce the same result (2). Thus, distractions alone are insufficient to increase people's food intake when eating with others. This might be due to the anxiety produced when eating with unfamiliar others (21).

On the contrary, one study failed to find any effect of group size on the amounts of food consumed by their participants. This was suggested to be due to the unfamiliarity between the individuals and their eating partners (20).

Social modeling

Five studies were identified in assessing the evidence of social modeling or intake matching on food intake. Two studies demonstrated that social modeling is observed when an individual eats with unfamiliar others (ICC= 0.73 to 0.93) (17,24). The food intake matching was found to be high when they were eating with unfamiliar others, where the participants resembled the food intake of their unfamiliar co-eaters. However, the total energy intake among the participants was actually higher when they were eating with familiar others compared to when they were with unfamiliar others.

On the other hand, one study (25) found that social modeling occurs more when an individual was eating with familiar others (ICC= 0.81). The authors also reported that the total energy intake among their study participants was significantly higher when eating with familiar others.

A study by Kaisri et al. (2015) (26) found that social modeling occurs in both familiar and unfamiliar situations. They also found that food intake matching with co-eaters was high in both situations (familiar and unfamiliar), with the ICC value of 0.79 and 0.89, respectively (26). Another study by Rosenthal and Marx (1979) also observed the social modelling effect in both

conditions although they did not report the ICC values. The participants in their study were subjected to one of three situations (appropriate models vs. inappropriate models vs. no model). In a duration of seven minutes, the models in the appropriate setting were required to consume five crackers (moderate pace) whereas the models in the inappropriate condition were required to finish 20 crackers (quick pace) (22). The study participants who ate with inappropriate models were found to consume more than those who ate with no models or appropriate models. The increase in food intake was influenced by the amount of foods eaten by their co-eaters rather than different levels of hunger or social desirability.

The review findings show that the social modeling of food intake where individuals tend to replicate the eating pattern of their co-eaters could occur both when eating with familiar or unfamiliar others. Creating a good impression is deemed to be more important when people eat with strangers as compared to when they do so with family members or friends; this may explain the modelling effects in unfamiliar situations. Other reasons for this are the desire of an individual to build a rapport with their unfamiliar partner or might be due to the anxiety produced when eating with unfamiliar others (21,24).

DISCUSSION

Social aspects when eating alone or in a group significantly impact the amount of our food intake and this is known as social facilitation (22). The current review found that seven studies agreed that eating alone would increase the food intake compared to eating with a partner. The social inhibition effect where the presence of others could suppress one's food intake could be why people would consume more when they are eating alone compared to when eating in the presence of others (12,18,20,26).

Five studies demonstrated that eating with others might increase the food intake rather than eating alone, as supported by a recent review and meta-analysis (27). The current review identifies a few social contexts that might increase intake when eating together: familiarity, body weight and age. Eating partner(s) or environment does play an essential role in eating behaviour. People commonly replicate their partner's eating pattern, e.g., they might be tempted to consume a large amount of food in a sitting if their companions do so (11). In addition, the current review also found that compared to eating with others, eating alone may reduce distraction; the individuals would be more focused on eating and would eat less than when they are involved in a conversation when others are presence (21).

The current review found that social facilitation might be influenced by the age group of individuals. For

instance, social inhibition seems to be more evident among teenagers than adults. Similarly, a study by deCastro (2002) found that social facilitation is manifested more often among adult population than in the elderly (28). In addition, body weight may also be a factor that determines how much individuals would eat. A review demonstrated that individuals' BMI influences their food intake, especially when they eat together (29). Overweight participants tend to eat less even though their co-eater eats a lot more. On the contrary, an experimental study found that neither age nor body weight affects the amount of food intake. Instead, the authors believed that it is influenced more by an individual's habitual intake (30).

A study in the current review did not identify that eating alone or with others would affect the energy intake. Eating alone might make certain individuals feel awkward or uncomfortable, thus leading to decreased intake and meal duration (19). However, the more time a person spends for eating, especially when in a group, may lead to a higher energy intake (31). This finding is consistent with the finding included in this review, which found that even when the group size was manipulated, the meal duration still caused increased food intake (19).

Social modelling, defined as individuals' tendency to use others' eating behaviour to reference their own eating behaviour and match their intake with their eating partner, could occur with familiar or unfamiliar others. The current review also discovered that total energy intake was higher when an individual eats with familiar others than with unfamiliar others, even though the social modelling was higher with unfamiliar others. Similarly Ruddock (2019), demonstrated that study participants who eat with friends or with familiar others tend to consume 28-48% higher total energy compared to those eating alone or eating with unfamiliar others (27). Thus, it can be summarized that familiarity increases food intake when eating with others. People who eat with familiar others would increase their food intake compared to eating with unfamiliar others because it is more comfortable and pleasant.

On the contrary, the review findings also described that people tend to imitate their eating partner's eating patterns regardless of familiarity. This was supported by a relatively recent study (32) with three experimental conditions in which the participants were exposed to no-intake, low-intake, and high-intake confederate conditions. The results were consistent with the previous studies, where the participants tended to model their confederate's eating patterns. Interestingly, they also discovered that only study participants with a high self-control had the ability to govern their food intake rather than following the confederates eating pattern.

Social modelling is evident in both situations familiar and unfamiliar others. It can be concluded that the

amount of food consumed is very much dependent on the eating partner's intake. In studies involving adults, it was shown that the participants tend to eat more when eating with other companions, regardless familiar or unfamiliar, than when eating alone (20,27).

The current review did not apply any restriction in terms of participants, setting, body weight status and food measurements (used in the experiment) on the included studies. As such, the findings of this review is general and not specified to a particular group or study population only. However, only studies that were conducted in a laboratory setting were included in this review for standardization purpose. Thus, future reviews should also include other type of studies such as those that use observational method of data collection to determine the social facilitation and social modeling effects on food intake in real life settings.

CONCLUSION

Social life has a considerable effect on an individual's food intake. For social facilitation, more studies indicated that people tend to eat more when alone than in groups. On the other hand, studies on the social modeling effect indicated that the presence of familiar or unfamiliar others may either increase or limit an individual's food consumption, depending on how much their eating partners consume. In both situations, good self-control is crucial for individuals to practise moderation and restrain from overindulgence, regardless of whether they are eating alone or with people whom they are or are not familiar with.

REFERENCES

1. Chae W, Ju YJ, Shin J, Jang SI, Park EC. Association between eating behaviour and diet quality: Eating alone vs. eating with others. *Nutr J*. 2018;17(1):1–11. doi: 10.1186/s12937-018-0424-0
2. Mekhmoukh A, Chapelot D, Bellisle F. Influence of environmental factors on meal intake in overweight and normal-weight male adolescents. A laboratory study. *Appetite* [Internet]. 2012;59(1):90–5. doi:10.1016/j.appet.2012.03.021
3. Bellisle F, Dalix AM, Airinei G, Hercberg S, Péneau S. Influence of dietary restraint and environmental factors on meal size in normal-weight women. A laboratory study. *Appetite*. 2009;53(3):309–13. doi: 10.1016/j.appet.2009.07.006
4. Prentice AM. Overeating: the health risks. *Obes Res*. 2001;9 Suppl 4. doi: 10.1038/oby.2001.124.
5. Kearns K, Dee A, Fitzgerald AP, Doherty E, Perry IJ. Chronic disease burden associated with overweight and obesity in Ireland: The effects of a small BMI reduction at population level. *BMC Public Health*. 2014;14(1). doi: 10.1186/1471-2458-14-143.
6. Pheasant H. Social, behavioural and other determinants of the choice of diet Health and

- Social Behaviour: Social, behavioural and other determinants of the choice of diet. *Public Health Textbook*. 2008. p. 1–4.
7. Blascovich J, Mendes WB, Hunter SB, Salomon K. Social “facilitation” as challenge and threat. *J Pers Soc Psychol*. 1999;77(1):68–77. doi: 10.1037//0022-3514.77.1.68.
8. L D. Social Learning Theory (Bandura) in Learning Theories [Internet]. Learning Theories. 2019. Available from: <https://www.learning-theories.com/social-learning-theory-bandura.html>.
9. Hermans RCJ, Salvy S-J, Larsen JK, Engels RCME. Examining the effects of remote-video confederates on young women’s food intake. *Eat Behav*. 2012;13(3):246–51. doi: 10.1016/j.eatbeh.2012.03.008
10. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*. 2021;372. doi: 10.1136/bmj.n71.
11. McFerran B, Dahl DW, Fitzsimons GJ, Morales AC. Might an overweight waitress make you eat more? How the body type of others is sufficient to alter our food consumption. *J Consum Psychol*. 2010;20(2):146–51. doi: 10.1016/j.jcps.2010.03.006
12. Bevelander KE, Anschütz DJ, Creemers DHM, Kleinjan M, Engels RCME. The Role of Explicit and Implicit Self-Esteem in Peer Modeling of Palatable Food Intake: A Study on Social Media Interaction among Youngsters. *PLoS One*. 2013;8(8). doi: 10.1371/journal.pone.0072481
13. Vartanian LR, Sokol N, Herman CP, Polivy J. Social models provide a norm of appropriate food intake for young women. *PLoS One*. 2013;8(11):1–9. doi:doi.org/10.1371/journal.pone.0079268
14. Pliner P, Bell R, Hirsch ES, Kinchla M. Meal duration mediates the effect of “social facilitation” on eating in humans. *Appetite*. 2006;46(2):189–98. doi:10.1016/j.appet.2005.12.003
15. Polman MAA, Larsen JK, Lodder GMA, Hirata E, IJsseldijk S, van den Broek N, et al. Effects of a non-eating confederate on food intake do not persist for everyone over time when people are left alone: An exploratory study. *Eat Behav*. 2018;30(2017):104–8. doi:10.1016/j.eatbeh.2018.05.011
16. Péneau S, Mekhmoukh A, Chapelot D, Dalix AM, Airinei G, Hercberg S, et al. Influence of environmental factors on food intake and choice of beverage during meals in teenagers: A laboratory study. *Br J Nutr*. 2009;102(12):1854–9. doi:10.1017/S0007114509991280.
17. Salvy SJ, Vartanian LR, Coelho JS, Jarrin D, Pliner PP. The role of familiarity on modeling of eating and food consumption in children. *Appetite*. 2008;50(2–3):514–8. doi: 10.1016/j.appet.2007.10.009.
18. Salvy SJ, Kieffer E, Epstein LH. Effects of social context on overweight and normal-weight children’s food selection. *Eat Behav*. 2008;9(2):190–6. doi:10.1016/j.eatbeh.2007.08.001
19. Clendenen VI, Herman CP, Polivy J. Social facilitation of eating among friends and strangers. Vol. 23, *Appetite*. 1994. p. 1–13. doi: 10.1006/appe.1994.1030.
20. Edelman B, Engell D, Bronstein P, Hirsch E. Environmental effects on the intake of overweight and normal-weight men. *Appetite*. 1986;7(1):71–83. doi: 10.1016/s0195-6663(86)80043-5.
21. Hetherington MM, Anderson AS, Norton GNM, Newson L. Situational effects on meal intake: A comparison of eating alone and eating with others. *Physiol Behav*. 2006;88(4–5):498–505. doi:10.1016/j.physbeh.2006.04.025
22. Rosenthal B, Marx RD. Modeling influences on the eating behavior of successful and unsuccessful dieters and untreated normal weight individuals. *Addict Behav*. doi:10.1016/0306-4603(79)90030-3.1979;4(3):215–21.
23. Salvy SJ, Jarrin D, Paluch R, Irfan N, Pliner P. Effects of social influence on eating in couples, friends and strangers. *Appetite*. 2007;49(1):92–9. doi:10.1016/j.appet.2006.12.004.
24. Salvy SJ, Coelho JS, Kieffer E, Epstein LH. Effects of social contexts on overweight and normal-weight children’s food intake. *Physiol Behav*. 2007;92(5):840–6. doi: 10.1016/j.physbeh.2007.06.014
25. Salvy SJ, Howard M, Read M, Mele E. The presence of friends increases food intake in youth. *Am J Clin Nutr*. 2009;90(2):282–7. doi: 10.3945/ajcn.2009.27658
26. Kaisari P, Higgs S. Social modelling of food intake. The role of familiarity of the dining partners and food type. *Appetite*. 2015;86:19–24. doi:10.1016/j.appet.2014.09.020
27. Ruddock HK, Brunstrom JM, Vartanian LR, Higgs S. A systematic review and meta-analysis of the social facilitation of eating. *Am J Clin Nutr*. 2019;110(4):842–61. doi: 10.1093/ajcn/nqz155.
28. De Castro JM. Age-related changes in the social, psychological, and temporal influences on food intake in free-living, healthy, adult humans. *Journals Gerontol - Ser A Biol Sci Med Sci*. 2002;57(6):368–77. doi: 10.1093/gerona/57.6.m368.
29. Suwalska J, Bogdański P. Social modeling and eating behavior—a narrative review. *Nutrients*. 2021;13(4). doi: 10.3390/nu13041209.
30. Liu J, Higgs S. Social modeling of food intake: No evidence for moderation by identification with the norm referent group. *Front Psychol*. 2019;10(FEB):1–9. doi: 10.3389/fpsyg.2019.00159.
31. De Castro JM, Brewer EM, Elmore DK, Orozco S. Social facilitation of the spontaneous meal size of humans occurs regardless of time, place, alcohol or snacks. *Appetite*. 1990;15(2):89–101. doi:10.1016/0195-6663(90)90042-7.
32. Hermans RCJ, Larsen JK, Lochbuehler K, Nederkoorn C, Herman CP, Engels RCME. The power of social influence over food intake: Examining the effects of attentional bias and impulsivity. *Br J Nutr*. 2013;109(3):572–80. doi:10.1017/S0007114512001390.