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Effects of social contexts on overweight and normal-weight children's food intake☆

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Abstract

This study investigates the effects of peer influence on the food intake of overweight and normal-weight children. A mixed factorial design was employed, with children's weight status (overweight vs. normal-weight) as a between-subjects factor, and social context (alone vs. group) as a within-subjects factor. A total of 32 children (*n*=17 overweight and *n*=15 normal-weight) between the ages of 6–10 years participated in this study. Findings from the random regression model indicated that overweight children ate more when alone than when in the presence of other youth, while in contrast normal-weight ate slightly more with others than they did when alone. Therefore, social context differentially impacts the eating behavior of overweight and normal-weight children. This study underscores differences in responses to the social environment between overweight and non-overweight youths, and suggests that social involvement may be an important tool in treatment and prevention programs for overweight and obesity.

Keywords

Peer Influence; Eating; Overweight; Children

1. Introduction

Obesity is a disorder of positive energy balance, with energy intake exceeding energy expenditure. Food is a powerful reinforcer in youth and one of the factors that may relate to the positive energy balance in obese youth is differences in the motivation to eat [1]. A number of studies on choice responding and preference have examined factors that influence the choice between eating and engaging in alternative activities [2]. However, most of this research isolates the individual from any possible source of social influence and few experimental studies have directly tested whether the social context influences the food intake of children and adolescents.

Studies in adults indicate that individuals often eat more and spend more time eating when in the presence of others than when alone (e.g., [3,4] see also [5]), a phenomenon known as social

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facilitation of eating. However, there is also evidence that the presence of others may impact differently on the eating behavior of overweight and normal-weight individuals. For instance, Krantz reported that overweight individuals chose higher-caloric meals in a cafeteria when they were alone than when in the presence of others [6]. In contrast, normal-weight individuals chose larger meals when with others than when alone, which is consistent with the literature on social facilitation of eating [7]. Krantz suggests that the social stigma associated with overweight and obesity accounts for these results, postulating that heightened concerns about weight led to reduced intake in obese individuals in the presence of others. By contrast, normal-weight individuals presumably increase their intake when in a group as a result of the social nature of the upcoming lunch — rather than eating on the run, the lunch becomes a social opportunity [6]. This logic follows the 'time extension' hypothesis put forth by De Castro [3] (see also [5]). Therefore, it appears that within adults, weight status is an important factor influencing the effects of the presence of others on food intake and eating behavior.

Herman et al. [8] developed a normative framework of the effects of others on food intake. This model can account for differences between overweight and normal-weight children in response to the social context. At its most basic level, the model posits that palatable food motivates eating, while the presence of others operates to determine when eating stops. That is, when eating with others, and in absence of clear guidelines, people use the behavior of others as an indication of "appropriate" eating. The amount that is appropriate to eat will depend on the social context (i.e., how much others are eating) and situations differ in the extent to which they increase or inhibit food intake. Presumably, people use the amount eaten by others to regulate their own intake to avoid incurring the stigma of excessive eating [9] and also because they believe that doing so will lead others to like and accept them (see [10] for an analysis of normative conformity).

Individuals' concerns with eating too much in front of others do not seem misguided. A well-substantiated literature indicates that negative stereotypes apply to those who eat excessively [11]. Research shows that a set of negative personality traits is attributed to people who are overweight and those who eat large amounts. It is also widely assumed that people become overweight because of a lack of self-control around food [12,13]. Overweight people are stereotyped as lazy, self-indulgent, unattractive, lacking self-esteem, socially inept, uncooperative, and intellectually slow [14–18]. Similarly, peer sociometric assessments consistently show that overweight children are perceived more negatively than are normal-weight youths. Children are less inclined to seek the company of overweight peers, and they do not enjoy interacting with them as much as they do with lean kids [19,20]. Rejected children often respond to victimization by disengaging from the social environment as a way of avoiding further prejudice [21,22]. Avoidance of social activities may not only deny children the opportunity to incorporate alternative leisure activities and recreations as part of a healthy lifestyle, but may also increase their involvement in obesigenic activities such as television watching and snacking [23].

A corollary of weight stigmatization is that overweight individuals may attempt to decrease their food intake in front of others to avoid incurring the stigmas related to overweight individuals who eat excessively. In fact, de Luca and Spigelman [24] found that obese college students ate close to nothing in the presence of a lean confederate, but consumed a large amount in company of an obese experimental confederate. Normal-weight participants' intake was unaffected by the confederate's weight. De Luca and Spigelman suggested that obese participants ate less in the presence of a normal-weight confederate due to self-consciousness and ate more with an overweight participant due to solidarity. The self-consciousness interpretation is similar to Maykovich's contention that overweight individuals suppress their intake in front of others in order to counteract the attribution that their excessive weight is due to excessive eating [10]. In sum, it appears as though social influences may operate differently

in overweight and lean individuals as a result of differences in social stigma, and potential concern in overweight (but not normal-weight) individuals about impressing other non-overweight individuals.

There has not yet been any systematic experimental study of the effects of social context on the food intake of overweight and normal-weight children. This is surprising as research shows that negative social interactions may be among the most detrimental experiences on unhealthy eating habits in youth [25] and that overweight youth are significantly more likely than their non-overweight peers to report binge eating [26–31]. In this respect, it is useful here to remember that pathological eating is more likely to occur when eaters are alone than when they are with others [32] and the introduction of another person into the eating situation is likely to stop the binge in its tracks [33].

The present study examines how the social context (i.e., alone versus presence of peers) influences overweight and normal-weight children's food intake and their time allocation to eating area and a play area. Given the evidence that stigmatization of overweight exists in children as well as adults; we expect differences in the eating behavior of overweight and normal-weight children. Some limited research in adults (i.e., [6]) has supported that this differentiation occurs; however, this research was observational and it assessed meal choice rather than actual food intake. In the present study, we expected that the presence of others would suppress the intake of overweight children, but facilitate the food consumption of normal-weight children. The free-eating paradigm used in the current study also allowed for testing of whether overweight and normal-weight children spend a differential amount of time playing versus eating depending on the social context. Consistent with the predictions for food intake, it was predicted that overweight children would spend more time in the eating area when alone than when with others, while normal-weight children were expected to spend more time in the eating area in the presence of others than when alone.

2. Method

2.1. Overview and design

This study tested the hypothesis that overweight children would eat more when alone than in the presence of others. The design used to test this hypothesis was a mixed design with weight (overweight vs. normal-weight) as a between-subjects factor and social context (group vs. alone) as a within-subject factor. The order of the group and alone sessions was counterbalanced. Half of the participants were tested alone in their first session and in group on their second session, while this order was reversed for the other half of the participants. The average time span between the two visits was one week.

A cover story was used in order to avoid demand effects that might arise had participants been told that the experimenters were interested in investigating their food intake. Youths were told that the experimenters were interested in their liking of games and food. Eating was incidental to what was described as the experimental task. Youths had access to several games which could be played alone or in groups while having access to a sizeable amount of pizza. This procedure makes it possible to examine the mutual influence "freely-eating" individuals have on one another rather than using a confederate accomplice to the experimenter (see also [3,7, 34,35] for similar methodologies). This paradigm does not involve working on a task which might influence the participants' intake, such as a forced tasting task in which participants are required to at least taste the food offered.

We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during this research. All procedures used in this study

were approved by the Children & Youth Institutional Review Board of the University at Buffalo.

2.2. Participants

Participants for this study included 15 normal-weight and 17 overweight males (n=16) and females (n=16) between 6–10 years of age. Weight and height were assessed by a trained staff member at the end of the session so that these measurements did not influence the experimental data. Weight was assessed with a digital scale assessed daily and height was assessed using a SECA stadiometer. On the basis of the height and weight data, BMI was calculated (BMI=kg/m^2). The BMI percentiles were further used to classify participants. Youth were considered overweight or at risk for overweight if they were above the 85th BMI percentile for their age and gender, and were considered normal-weight if they were at or below the 85th BMI percentile. These are the current guidelines for weight status in children and adolescents set forth by the Centers for Disease Control [36].

Families were recruited from newspaper ads and from our database of families who have volunteered for previous laboratory studies. Parents were screened by phone for their child's height, weight, a brief medical history, and ethnic background. Children were excluded if: they were below the 10th BMI percentile; had a cold or upper respiratory distress, which could influence olfactory and/or taste cues; were diagnosed with any current psychopathology or developmental disability; had any allergies to the study food; or were taking medications that could influence taste, appetite or olfactory sensory responsiveness (e.g. methylphenidate). If children met basic entry criteria, they were scheduled to come to the laboratory. The groups of children for the social sessions were formed while recruiting and scheduling. All groups were composed of 4 youths of the same gender and no more than 2 years apart. Seven groups were composed of two overweight and two normal-weight children; however, because of scheduling problems, one group was composed of one lean and three overweight participants. Although this small number precludes formal comparison, the last group showed the same pattern of results as the other ones and was therefore included in the analyses.

During the phone screening, parents were informed that the study would evaluate children's liking of food and games during two separate visits to the laboratory. It was explained that one session would involve three other children of the same age and gender (group condition), while for the other session their child would be alone while rating their liking of food and games (alone condition). It was also explained that children would have access to cheese pizza and several games and puzzles. Parents were instructed that the study required participants to abstain from eating for at least 2 h before the experimental sessions. They were also informed that, before starting the session, their child would be given a standard preload of a Trix or a Honey Nut General Mills Milk 'n' Cereal Bar TM (described below). The nutritional information of the food was provided upon request to allow parents to consider allergy or dietary concerns.

2.3. Procedure

Upon arrival to the laboratory, all children heard an "assent" script and were asked if they were willing to take part in the study; parents were also asked to read and provide written consent. Participants completed a same day recall of their food intake, with the help of their parents if needed, to ensure they had followed the eating recommendations and had refrained from consuming solid foods in the 2 h prior to their arrival. Participants were then given the cereal bar preload and parents and children were shown the experimental room.

The experimental room (1385 ft^3) was diagonally divided into two areas: an eating area and a play area. A line of blue tape divided the room into two equal halves, where the children were

instructed that one side was an “eating only” area, and the other was a “playing only” area. The experimenter made it clear to the children that they could alternate between areas, but were not allowed to cross the line into the play area with food, nor enter the eating area with games. The eating area was equipped with a table and 4 chairs, where each participant had access to his or her own sizeable amount of pizza (described below) and water. The play area included two bean bag chairs and several board games and activities (described below).

A camera was affixed to the wall of the laboratory room, and children were observed via a closed-circuit monitor located in an adjacent room. The experimenter observed the session and recorded the time spent (in minutes using a stopwatch) in each area to ensure the children were eating off of their own plates and not their peers’ ration of pizza. Group sessions were video-recorded in the event the experimenter missed any observable data, and were reviewed at the end of the experiment.

At the beginning of the experimental session, each participant was provided with a pre-weighed plate filled with pizza (described below). If a participant finished his/her plate of pizza, another plate of the same weight as the first one was provided. An unlimited supply of food was provided so that there was no ceiling to the amount of food consumed. After 45 min, the experimenter returned to the experimental room and participants’ height and weight were measured and were then returned to their parents. Weight and height were assessed by a trained staff member at the end of the session so that these measurements did not influence the experimental data. Children and parents were debriefed and they received a 20-dollar gift card for a shopping mall of their choice for their participation. Lastly, the remaining pizza was reweighed to determine participants’ food intake. All participants were tested between 1500 and 1800 h.

2.4. Food and games

General Mills Milk ‘n’ Cereal Bars (either Trix or Honey Nut Cheerios ™ depending on the child’s preference) were used as a preload. Both types of bars had an average weight of 40 g and 160 kcal. Upon recommendation of IRB, it was deemed not advisable to “force” the children to eat the bar entirely. Children were simply instructed (but not required) to eat the entire cereal bar provided. Most participants followed the instruction, but two participants did not finish their bars and their uneaten portions were controlled for statistically and did not significantly influence the results.

Cheese pizzas were delivered at the participants’ scheduled appointment time in order to ensure that the pizzas were hot and fresh. At the beginning of the session, each child received a small plate of pizza cut into small squares (approximately 1 in. × 1 in. pieces of pizza). The pieces of pizza were piled into a generous amount (≈ 200 g, 516 kcal). The pizza was cut into small pieces to remove any cue related to portion size as this could have influenced the amount children were eating. All children consumed at least some pizza.

As an alternative to eating, participants were provided with 17 different games and activities including some books, puzzles, board games and agility games (list available upon request to the authors). The majority of these games and activities can be played either alone or in a group.

2.5. Data analysis

Mixed-effects models (also called multilevel, hierarchical linear or random-effects models) provide a useful approach to account for interdependence in multiple observations within individuals and in group relationships [37–39]. Mixed models assume that the data within clusters are dependent among the observations. This is determined by the covariances among the regression coefficients and can be characterized by a covariance function [40]. The

outcomes at the individual level are modeled taking into consideration the dependence of observations within groups and individuals [41]. These models allow simultaneously estimating the parameters of the regression model and the variance components accounting for the data clustering [37]. A mixed-effects model analysis, using SYSTAT Software, [42] was used to analyze these data. Participants' weight status, the social context (alone vs. group) and the interactions between these variables were entered as fixed effects into the models as predictors of participants' pizza consumption in kilocalories. Gender was also entered as a fixed effect into the model, in order to ensure that there were no differences in food intake between girls and boys.

3. Results

3.1. Participant characteristics

A summary of participant characteristics (i.e., weight and age) across the groups can be found in Table 1. There were no significant differences between groups for the amount eaten prior to coming to the laboratory, based on participants' same day food recalls (all *p*'s>.15). In this study, 18% of the sample was minority, with 7% African–American and 11% Hispanic or Latino.

3.2. Food Intake

Results from the mixed-effects model indicated that the participants' weight status, $F(1,27)=8.68$, $p<0.01$, and the interaction of weight status by social context, $F(1,27)=39.90$, $p<0.0001$, were significant predictors of participants' pizza intake (Fig. 1). Differences of least square means revealed that when they were alone, overweight children consumed more kilocalories, $M=614.5$, SE=58.0, than when they were with peers, $M=470.4$, SE=57.5; $t(27)=-3.8$, $p<0.001$, and also consumed more kilocalories than normal-weight children eating alone, $M=254.8$, SE=46.3; $t(27)=4.85$, $p<0.0001$. Normal-weight children ate more with other children, $M=418.2$, SE=46.2, than when alone, $t(27)=5.46$, $p<0.0001$. There was no difference between overweight and lean participants' intake in the "group" condition. Participants' gender did not predict participants' intake ($p=0.4$).

3.3. Time spent eating

The time participants spent in the eating area (in minutes) was predicted by participants' gender, $F(1,27) = 14.86$, $p<0.001$, and by the interaction of weight status by condition, $F(1,27)=6.97$, $p<0.05$. Differences of least square means indicated that overall girls, $M=14.8$, SE=1.12, spent more time eating than boys, $M=8.64$, SE=1.15; $t(27)=3.85$, $p<0.001$. Normal-weight participants spent more time in the eating area when in the group condition, $M=14.62$, SE=1.42, than when alone $M=8.32$, SE=1.46; $t(27)=3.10$, $p<0.01$. Overweight participants spent somewhat more time in the eating area when they were alone, $M=13.10$, SE=1.79, than when they were in the presence of peers $M=10.83$, SE=1.78, but this difference was not statistically significant, $p=0.38$.

4. Discussion

This study examined how the social context (i.e., alone versus presence of peers) would influence the food intake of overweight and normal-weight children using a free-eating paradigm. The results of this study supported the hypothesis that social context differentially impacts the eating behavior of overweight and normal-weight children. Overweight children ate more when alone than when with a group of peers, whereas normal-weight children ate more when with other youths than when alone. Furthermore, when alone, overweight children ate more than normal-weight children, whereas the intake of overweight and normal-weight children eating in a group did not differ. These findings are consistent with observational

research in adults [6]. To our knowledge, this is the first study to demonstrate the differential effects of social context in overweight and normal-weight children.

These findings suggest that the presence of others facilitated the consumption of normal-weight children (e.g., [4,7]) but suppressed that of overweight children. One account based on impression management of eating is that overweight participants suppressed their intake in front of others to convey a good impression. Research shows that overweight youths are aware of weight stigmatization, [25,29,31,43–45] and a corollary of these prejudiced attitudes is that overweight individuals may suppress their food intake when in front of others to avoid incurring the stigmas attributed to overweight individuals [9,11], and also because they believe that doing so will increase social approval (e.g., [10]). An alternative explanation based on modeling, is that overweight youth relied on their co-eaters' intake to determine how much they should eat, which is consistent with an informational interpretation of conformity [10]. In this perspective, the information that is conveyed by the peer (the amount consumed) would be the active agent of influence. Finally, it is also possible that suppression of intake and eating conformity serve a same overarching goal (conveying a good impression) and that in some social contexts self-enhancing motives are served by restricting intake as well as through behavioral conformity (see also [46]). These mechanisms were not directly tested in the present experiment and future research ought to explore the social motives accounting for differences between overweight and non-overweight youth with regard to social eating.

Albeit the equivocal nature of the mechanisms, the presence of the other participants seem to have operated as a brake and set the limit on overweight children's pizza consumption. This is consistent with Herman et al. normative framework [8]. Overweight participants regularly (and surreptitiously) asked the experimenter to bring their leftovers of pizza home at the end of the social session, which suggests that they *wanted* to eat more, but limited their intake in front of their peers. Conceivably, the heterogeneous nature of the groups in terms of weight status may be important to consider when reflecting on the pattern of results. A recent study conducted in our laboratory indicated that overweight pre-adolescent girls eating together ate significantly more than overweight children eating with normal-weight peers and normal-weight children eating together [47]. Thus, it is possible that the presence of a lean (but not overweight) peer would be sufficient to trigger impression management motives and suppress food intake [48–50].

There is evidence that the experience of being victimized by peers can lead overweight children to avoid taking part in activities, such as physical education classes or sports, to avoid peer victimization [51]. Our findings suggest that the social context can also affect time engaged in eating-versus playing-related activities. Compared to overweight children, normal-weight participants spent less time in the in the eating area (and more time playing) when alone compared to when they were in the company of peers. When in the presence of others, normal-weight children spent more time in the eating area, but they were not consuming more food than overweight kids. Anecdotal observations indicated that normal-weight children were spending more time talking to their peers while in the eating area, while overweight participants were spending more time eating. Findings do suggest that normal-weight (but not overweight) children allocate more time to activities that are alternatives to eating when alone; whereas the prediction that overweight children would spend more time eating than playing when alone was not supported. However, since overweight children were eating more when alone than when in group these findings suggest that they were eating faster (i.e., rate of eating was higher) when alone than when in group.

Finally, since playing was placed in competition with eating, differences in food intake could also be due to social influence on play or some combination of social influence on eating and play. For example, the play behavior of the overweight children may be influenced more by

the group than for normal-weight children and as a result played more and ate less. One possibility is that overweight children were simply not as interested in play as normal-weight children and thus ate more when alone. Further research ought to investigate the relative reinforcing value of alternative activities, such as play, in overweight and non-overweight youth.

This study is not without limitations. First, as the results of our recent study indicate [52], the weight-status composition of the groups likely qualified our findings. The groups of peers were composed of both normal-weight and overweight participants. Had the groups been composed of homogeneous weight categories, the pattern of results may have differed (see also [24]). The fact that all groups were heterogeneous makes impossible to determine whether the presence of others *per se*, the weight status of the peers, or the food consumption of the partners accounted for children's food consumption. Second, although the restriction of having to choose between playing and eating was useful for experimental control, it may have limited the interpretation of the findings. Future studies might benefit from using a similar paradigm to look at simultaneous access to food and games. Nevertheless, the data depict a coherent pattern of results which is intuitively appealing and suggest new directions for research in the area of peer influence on overweight children's eating behavior.

Assuming that modeling accounts (at least in part) for these findings, social isolation may reduce opportunity to benefit from the normative influence of their peers. Furthermore, the presence of peers may not only sets the limits of eating but also provides the occasion for alternatives to eating [47,53]. By contrast, weight criticism can impose constraints on access to alternatives and these constraints may account for the impediments met when trying to substitute alternatives to overeating in overweight youth. This research can help in the development of interventions testing whether increased social involvement can be used as a tool for lifestyle changes in overweight children. The idea is that increasing the time spent on social alternatives may redistribute time allocation to activities that are alternative and/or incompatible with eating. Other studies conducted in our laboratory support this possibility.

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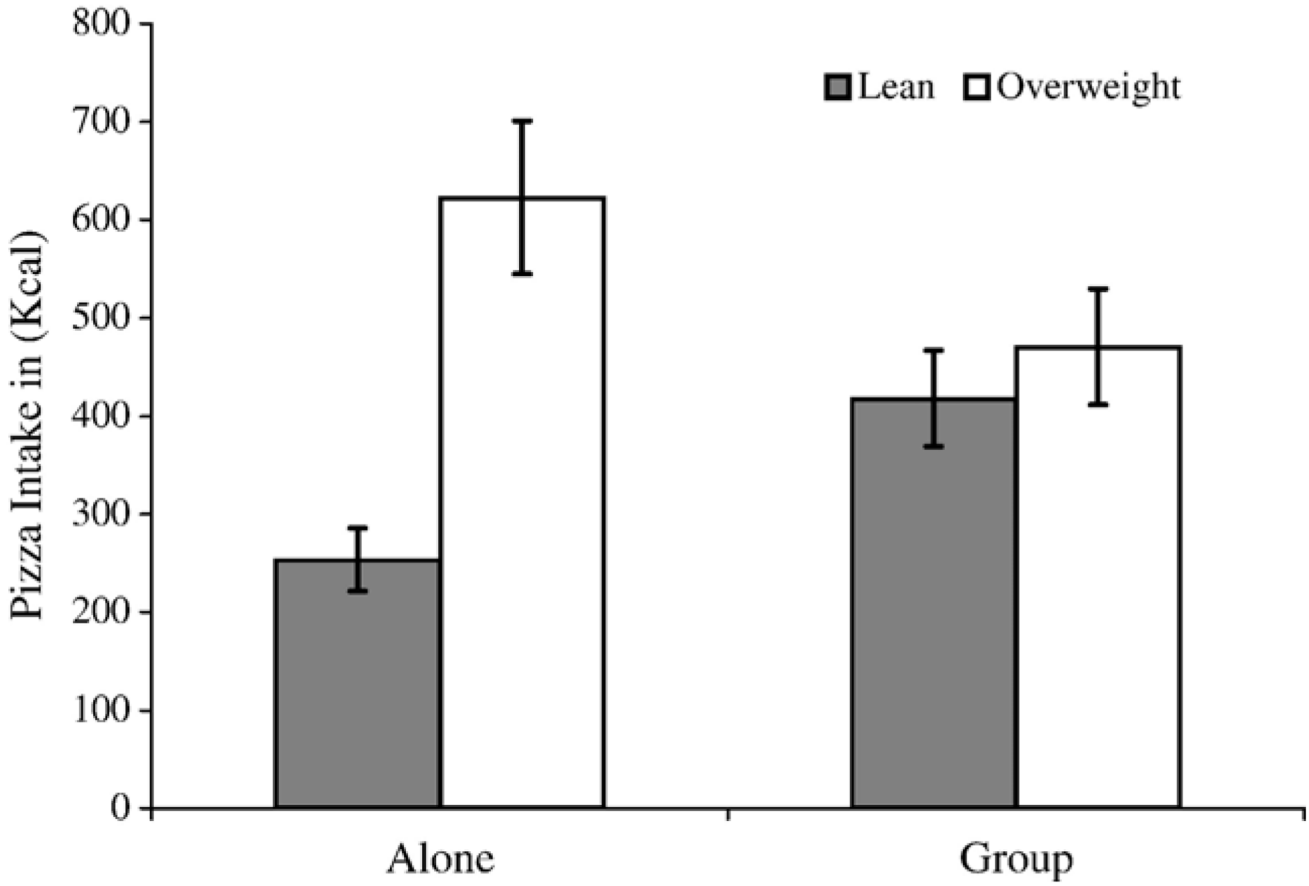

Fig. 1.
Overweight and normal-weight children mean food consumptions (kcal) and standard errors when alone and in presence of peers.

Table 1

Mean Body Mass Index and age (SD) of participants across conditions

	Male		Female	
	Age	**BMI**	**Age**	**BMI**
Overweight	8.6 (1.7)	21.3 (2.4)	7.7 (1.2)	20.7 (2.7)
Normal-weight	8.2 (1.2)	16.5 (1.5)	7.3 (1.1)	14.8 (1.1)