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Preschoolers' and Adults' Recognition of the Impact of Activities on Weight

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Abstract

Two studies examined if preschoolers and adults recognized the impact of physical and sedentary activities on height and weight. Study 1 investigated if participants associated physically active activities with being thin and sedentary activities with being heavy. Study 2 examined if preschoolers could benefit from being taught the role of activities on height and weight. The results from Study 1 demonstrated that adults associated being heavy to engaging in physically sedentary activities but in Study 2, they associated being thin to engaging in physically active activities. However, preschoolers across both studies did not recognize the role that activities played on weight. Teaching preschoolers about the impact of activities did not have a significant effect on their performance. The results from these studies also indicate that adults erroneously reason about the impact of activities based on whether they view the type of activity as being positive or negative. Preschoolers' lack of knowledge in this area could be due to the lack of consistent environmental input or that they are not conceptually ready to learn about this topic. These findings highlight the urgent need for parents and educators to emphasize the importance of physical activities in maintaining a healthy lifestyle in early childhood.

Keywords: Activities on weight, biological concepts, cognitive development, reasoning, instruction

1. Introduction

One of the important factors that determines a healthy weight is not only healthy nutrition but also regular physical activities. In many Western settings, a large proportion of children and adolescents do not meet the recommended physical activity guidelines and, typically, those who were more physically active had lower levels of body fat than those who were less active. As children get older, active behaviors get displaced by more sedentary ones which in turn contributes to reductions in physical activity and energy expenditure. Thus, the engagement of children and adolescents in physical activities should be one of the fundamental goals of the prevention of obesity (Raman, 2018).

Most of the studies in the cognitive developmental literature have focused on the impact nutrition has had on height and weight (Raman, 2018; Slaughter & Ting, 2010; Wellman & Johnson, 1982). One of the reasons that there is very little research in the area of how children recognize the impact of activities on height and weight, could be because of parental emphasis on healthy nutrition (Birch, 2000). Children (at least until the age of 5) get a lot of input about the benefits of healthy eating from their parents but there is minimal emphasis on the impact of activities on weight. However recently, there have been a few studies that have explored the role of activities on height and weight (Raman, 2019; Raman, Marchiak and Gelman, in press). Baxter, Collins and Hill (2015) investigated how children's understanding of weight change is achieved, what their motivation is for weight change and the consequences of weight gain or weight loss. Overall, preschoolers (mean age 5.2 years) attributed weight change more to food than exercise. Even at this young age, weight loss was viewed positively and the motivations for weight loss was for physical or social reasons such as health, physical activity, concern for appearance and negative behaviors of weight gain from others. This demonstrates that even preschoolers are aware and receptive to the impact of food and activities on weight. Lanigan, Barber and Singhal (2010) found that 3- to 5-year-olds' have a greater understanding of the impact of healthy eating than healthy physical activities. They could identify and explain the benefits of eating healthy foods in comparison to identifying physical activities that would contribute to their physical health. This study with preschoolers suggests that an understanding of activities on bodily effects may develop later than their understanding of food. Raman, Marchiak and Gelman (in press)

found that by age 3, children reasoned that unhealthy choices are associated with greater weight, and by 4-5 that healthy choices are associated with greater height. However, children's and adults' strongest links were between unhealthy food and greater weight, suggesting that the role of activities tends to be underestimated in people's conceptions of body size. Similarly, Raman (2019) found that it was only around the ages of 7-8 that children recognized the differentiated role of physically active and sedentary activities on weight. Preschoolers reasoned that all activities would influence weight without making a distinction of the impact of active and sedentary activities. Other studies have also examined children's recognition of the impact of healthy foods and activities on growth (Lasky & Eichelberger, 1985; Irwin et al., 2005).

Research in the medical field has also demonstrated that physical activities can impact weight. Burgess and Broome (2012) have demonstrated that preschoolers can identify children who are of normal weight and those who are overweight indicating that preschoolers are sensitive to differing body sizes of normal and overweigh individuals. Hills, Andersen and Byme (2011) reported that physical activities (that tend to decrease as children approach adolescence) play an important role in the prevention of becoming overweight and obesity in childhood and adolescence which in turn reduces the risk of obesity in adulthood. Wardle, Guthrie, Sanderson, Birch and Plomin (2001) investigated food and activity preferences in preschoolers whose parents were obese/overweight or normal-weight/lean. They found that children from obese/overweight families had a higher preference for fatty foods in a taste test, a lower liking for vegetables and were more likely to overeat. They also had more of a preference for sedentary activities and pastimes and as they got older, active behaviors got displaced by more sedentary ones resulting in reductions in physical activity and energy expenditure.

Other studies have demonstrated that older children discounted the role of activities on weight. Economos et al. (2012) found that with children aged 13 and older 41.5% of them mainly attributed being overweight to food-related causes. Only 9% of children mentioned lack of physical activity as being a contributing factor. In another study, Kostmann (2012) found that Swedish middle school students linked psychosocial relationships (such as ties with family and friends) as being a fundamental contributing factor to health rather than biological mechanisms per se. Hesketh, Green, Salmon, and Williams (2005) conducted a study with second grade and fifth grade children to elicit their views regarding social and environmental barriers to healthy eating and healthy physical activities. While most of the children could easily identify physically active pursuits as healthy (which would contribute to fitness and fat reduction), second graders, were not clear about the implications of sedentary activities for physical health. They judged that video games were healthy as they were healthy for the brain. Overall, the work that has been done with school-aged children demonstrates that although they have a fundamental awareness of the impact of the role of physical activities on weight, their comprehension of these activities on weight may be somewhat limited.

As described above, there has been little work that has examined preschoolers' understanding of the role of physical activities on the body. The few studies that have focused on children's perceptions of physical activities have examined children's perceptions of the impact of being overweight or environmental factors that can lead to different body sizes. The studies that have been conducted in the cognitive developmental literature have specifically presented children with fixed choice options to select from. However, as children get older, they will have the opportunity to select which activities they can choose to engage in. Thus we need to determine if children associate certain body types with engaging in certain activities by presenting them with a variety of active and sedentary activities.

The following two studies aim to explore the role that preschoolers and adults think activities play on weight. Study 1 presents children and adults with caricatures of girls and boys of different weights and a variety of physically active and sedentary activities. Participants are then asked to select which activities they think the boy/girl engages in. The goal of this study is to determine if preschoolers associate body size (thin/heavy) with certain kinds of activities. Study 2 presents preschoolers with scenarios of characters who engage in activities on a daily basis. They are then asked if they think the character will be thin or heavy. The children then go through a 'teaching' phase and are then tested to determine if the teaching had an impact on their knowledge of activities on body size.

These two studies are designed to shed light on: (a) whether preschoolers spontaneously associate activities to weight; (b) what role (if any) does 'teaching' have on preschoolers' recognition of the role of activities on weight? Nguyen, McCullough and Noble (2011) examined whether young children with coherent and causally related information in a theory-based lesson would facilitate their learning about the concept of health. This study used a pretest/lesson/posttest design, plus a 5-month follow-up. Children were randomly assigned to either a theory-based lesson, a nontheory lesson or a control lesson (i.e., 20 children received no lesson). Overall, the results showed that

children in the theory condition had a more accurate conception of health than children in the nontheory and control conditions. This suggests the importance of theories in children's learning of complex, real-world concepts.

If children are ready to conceptually learn about the impact of activities on weight, the teaching should benefit children and their performance should be significantly better on the post-training than pre-training sessions. If they are not conceptually ready to learn about the role of activities on weight, then the 'teaching' should have no significant effect on their post-training performance.

The focus was on preschool-age children (3- to 5-year-olds), for two reasons. First, relatively little is known in the cognitive developmental literature regarding children's understanding of physical activities at this age since most of the research has focused on older children (e.g., Carey, 1985; Inagaki & Hatano, 2002). These early childhood behaviors can set the stage for later habits and health consequences, so it is particularly important to examine these initial beliefs and expectations. Second, prior work that has focused on biological reasoning from 3-5 years of age reveals important developmental changes over this period (e.g., Herrmann, Medin, & Waxman, 2012; Herrmann, Waxman, & Medin, 2010). An adult sample has been included to have a measure of the developmental endpoint for comparison purposes. Informed consent was obtained for all participants across both studies.

2. Study 1

Study 1 assessed 4-5 year olds' and adults' recognition of the impact of physical activities on weight. The following hypotheses are possible: (a) since previous research has indicated that it is only in middle childhood that children recognize the impact of physical activities on weight (Raman, 2019), we would not expect preschoolers to make a clear distinction of the impact of active and sedentary activities on weight but would expect to see a selection of a mixture of activities; (b) however, since we are giving preschoolers a wide variety of activities to select from (as opposed to binary choices), we might see preschoolers associating some activities with a thinner or heavier body size than others.

2.1 Method

2.1.1 Participants

Twenty-four 4 and 5 year olds (M age = 4.51 years: range = 4.1 years to 5.5 years; 13 males and 11 females) and 24 adults (M age = 20.4 years; range = 18.6 years to 23.1 years; 7 males and 17 females) participated in the study. Children were recruited from preschools in two small Midwestern cities in the United States and adult participants were part of an undergraduate subject pool at a public Midwestern university. Although ethnic and racial demographic information was not collected, most the children were from White middle-class families. Participants who took part in one study did not participate in the pretesting or any other study.

2.1.2 Measures

The activities that were included in the studies were selected from a larger set of physical and sedentary activities that were pretested with a separate group of preschoolers and adults. The preschool and adult pretest groups consisted of 12 participants each. Participants were shown pictures of various physically active and sedentary activities and they were asked to judge if each of the activities took 'a lot of energy' or 'little energy'. The term 'physical activities' refers to high metabolic activities and 'sedentary activities' refers to low metabolic activities. The activities that were finally included in each of the studies were ones where the participants across both age groups judged as taking up 'a lot of energy' for the physical activities and 'little energy' for the sedentary activities at least 95% of the time.

For the study, participants were presented pictures of thin and heavy characters one at a time and asked to select the activity(ies) he/she thought the character engaged in. The materials for the main study included four vignettes. An example of a vignette is the following: 'This is Elise. Which activity or activities do you think Elise takes part in? The presentation of the vignettes was randomized for each of the participants.

2.1.3 Procedure

Each participant received four vignettes. Given that the participants were 4-5 years of age, we decided to limit the study to 4 vignettes as this would easily hold the focus and interest of the participants. Also, since this study was a free choice response where participants could select as few or as many activities as they wanted, presenting several more vignettes might result in a repetitive style of answering where they routinely select the same responses for all the vignettes.

The children were shown caricatures of boys and girls who were thin and heavy (2 caricatures were heavy and 2 were thin). They were then shown a sheet of paper with pictures of active and sedentary activities (a playground

with a jungle gym, swimming, trampoline, soccer, TV, video games, piano, and painting). These activities were a subset of a larger group of activities that were tested with children and adults. Participants were told that they could select as many activities as they wanted. For both age groups, the participants could either respond verbally or point to the figure of the caricatures. Their responses were noted verbatim by the experimenter.

2.1.4 Coding

Although we realize that weight is determined by multiple factors such as genetics, nutrition and metabolism, when all other things are held constant, we are making the assumption that thin people engage in more physically active activities than heavy people do. So for the purposes of coding for this study, for the thin caricatures, any physically active activities that were selected were coded as '1', for the heavy caricatures, any of the sedentary activities were coded as '1'. All other responses were coded as '0'. The participant choices were summed across the four vignettes giving each participant a possible minimum score of '0' and a maximum score of '4' in each category (thin and heavy).

2.1.5 Data Analyses

A 2 grade (preschool; college) x activity totals repeated measures ANOVA was conducted with grade as the between-subjects factor. The analyses revealed a significant body size x grade interaction, $F(1,48) = 14.54$, $p < .001$, $\eta_p^2 = .23$, and a significant grade effect, $F(1,48) = 14.58$, $p < .01$, $\eta_p^2 = .23$. Post-hoc tests revealed that college students selected significantly more sedentary activities for being heavy than selecting physically active activities for being thin, $p < .01$ (Ms = 5.46 for active activities for thin and 7.0 for sedentary activities for heavy).

2.2 Discussion

The purpose of this study was to determine if preschoolers and adults associate body size with activities. The results demonstrate that preschoolers do not associate body size with engaging in different types of activities. Adults however, associate being heavy with engaging in sedentary activities but they do not associate being thin with engaging in physically active activities.

What could be some of the potential reasons that preschoolers do not associate body size with activities and that adults associate only being heavy to engaging in sedentary activities but not associate being thin with being active? First, preschoolers do not get much input from parents or teachers about the importance of physical activities in maintaining a healthy weight. Birch (1999) has reported that parents primarily focus on the impact of nutrition on growth ('eat your peas and you will grow tall'). Thus, without input about this concept, it is not surprising that preschoolers do not have an accurate idea of the impact of activities on weight. Second, there is hardly any literature that discusses parental input to children about the impact of activities. Most of the studies have concentrated on parental perceptions of weight, nutrition and physical activities. Raman, Ford, and Cogswell (in progress) are examining the input that mothers give their children about the impact of engaging in physical and sedentary activities.

Third, some of the sedentary items that we presented like watching TV and playing video games could have been viewed as positive activities by preschoolers as these are activities they like to engage in, thus resulting in preschoolers not associating these activities with being heavy. Even for parents, activities such as watching TV or playing video games are probably not associated with weight gain as explanations as to why children should not engage in them. They are more likely to talk about the impact of these activities on intellect such as these types of activities are not being good for your brain or your eyes if you play too many video games.

It was also interesting that adults associated being heavy with sedentary activities but they did not associate being thin with necessarily being physically active. This could be because being sedentary in our society is often associated with being overweight especially by engaging in activities such as watching TV and playing video games. Infact, all the adult participants selected 'watching TV' and 'playing video games' as the activities that the heavy characters were engaged in. Sedentary activities such as watching TV and playing video games is also seen as ones that are engaged in by people who are overall sluggish and somewhat lethargic giving these activities a negative connotation. Another factor is the media which emphasizes the role of exercise for heavy adults to lose weight indicating being heavy is due to one's own lifestyle. However adults might be attributing being thin to other factors (apart from physical activities) such as a high metabolism or genetics.

This study clearly demonstrates that preschoolers do not associate body size with activities and adults selectively associate being heavy to engaging in sedentary activities. The question that this leads to is whether preschoolers cannot distinguish the impact of activities on body size due to the lack of input or whether they are not conceptually ready to learn about this concept. Study 2 explores this issue by first testing preschoolers on their knowledge of the impact of physical and sedentary activities by using a forced-choice format and then teaching the

same group of children on the impact of physically active or sedentary activities on weight and then testing them on this concept after a temporal gap. Thus Study 2 will shed some preliminary light as to whether preschoolers can actually learn about the concept of the impact of activities on weight if they are presented with the appropriate information or if infact teaching does not enhance their conceptual understanding on this topic.

3. Study 2

This study examines if preschoolers can be taught the impact of physically active and sedentary activities on weight. Recall that in Study 1, preschoolers did not recognize the impact of activities on weight. The question this generates is whether children lack knowledge in this area because they have not been taught about this concept or if they lack knowledge in this area because they are cognitively not ready to learn about this concept. In this study, preschoolers will first be tested on their knowledge of the impact of activities on weight, they will then be presented information either with causal or associative links that link activities to being thin or heavy. They will then be retested on the original vignettes to determine if their performance improves after the training.

3.1 Method

3.1.1 Participants

Twenty-four 4 and 5 year olds (M age = 4.9 years: range = 4.2 years to 5.8 years; 14 males and 10 females), participated in the study. Children were recruited from preschools in a small Midwestern city in the United States.

3.1.2 Procedure

There was a pretest with 12 preschoolers that assessed children's understanding of the words 'thin' and 'fat'. The children were presented with caricatures of thin and fat people (these caricatures were not used in the study) and were asked to identify if they were thin or fat. Other studies have also used the words 'thin' and 'fat' with preschoolers that demonstrates that they understand these terms (Raman, Marchiak and Gelman, in press; Raman, 2018).

There were three phases to this study. The first phase tested participants on their knowledge of the impact of sedentary and physically active activities by presenting them with four physically active vignettes and four sedentary vignettes. The second phase was the teaching phase where each participant received a new series of four vignettes that described physically active activities and four vignettes that described sedentary activities. These vignettes used different activities than the ones used in the first phase. Two vignettes in each of these categories presented associative links, whereas the other two presented causal links (examples are presented in the 'measures' section). A week later the same participants were tested on the same vignettes that they were presented during the pre-teaching phase in order to determine if their performance had improved after the training. The vignettes were read to the participants and their oral responses were written down verbatim by the experimenter.

3.1.3 Measures

Measures for phase 1 of the study: Participants were read 4 vignettes that described a boy or girl who engaged in physically active activities and 4 vignettes that described a character engaged in sedentary activities. The children were then asked if the person would be thin or fat. An example of a vignette would be 'There is a girl named Ingrid. Ingrid spends a lot of time watching television every day. Do you think Ingrid would be thin or fat? Children were shown pictures of the activities (with no characters in them) but not the characters in the vignettes. Thus engaging in a Lego activity would be portrayed as a stack of Legos.

Measures for phase 2 of the study: This was the teaching phase. Participants were read a total of 8 vignettes, 4 describing active activities and 4 describing sedentary activities. Participants were told to listen carefully to each of the statements that were read. Each participant was assigned to either the association condition or the causal conditions. An example of a vignette with associative links is the following: 'There is a boy named Kai. Kai spends a lot of time playing Legos everyday so he is fat. An example of a vignette with causal links is the following: 'There is a boy named Kai. Kai spends a lot of time playing Legos everyday, so he doesn't burn a lot of energy so he is fat. The key difference between the two types of vignettes is that the causal one explains as to why the person is thin or heavy whereas the associative ones just link the activity with the body size without an underlying explanation. (see Table 1 for the items used in phase 1 and phase 2 of the study).

Phase 3 of the study was implemented a week after phase 2. The same participants were read the vignettes that they were tested on in phase 1 to determine if the teaching in phase 2 had improved their recognition of the role of activities on body size. The vignettes were randomized for each of the participants in phase 1 and 3. The response options (thin or fat) were counterbalanced across participants.

Table 1. Items used in Study 2 for the pre and post-teaching sessions

Items	Activities
Pre-teaching	swimming, soccer, baseball, playing in the playground, coloring, piano, reading, watching TV
Teaching	basketball, trampoline, gymnastics, running, video games, computers, Legos, board games

3.1.4 Data Analyses

The goal of this study was to determine preschoolers' knowledge of the impact of activities on body size and then determine if training would have an impact on their learning about this concept. Two sets of data analyses were conducted. The first set of analyses was conducted for the pre-teaching phase for the preschoolers and adults. For the pre-teaching phase of the study (Phase 1), a 2 body size (thin; heavy) x grade repeated measures ANOVA was conducted. The results demonstrated a significant main effect for body size, $F(1,48) = 11.23$, $p = .002$, $\eta_p^2 = 0.19$ and a significant grade effect $F(1, 48) = 67.2$, $p < .01$. Overall participants gave more 'correct' responses (for the physically active activities than the sedentary activities (Ms = 3.08 for the physically active activities versus 2.26 for the sedentary activities). This indicates that participants in general thought that people who are thin engaged in more physically active activities than heavy people engaging in sedentary activities.

For the post-training phase 3 of the study the same set of preschoolers were tested on the same items that they were tested on in phase 1 of the study. A 2 body size (thin;heavy) x condition (association; causal) repeated measures ANOVA was conducted. The results indicated that preschoolers did not differentiate between activities and body size and the teaching had no effect on their performance on the vignettes (Ms = 2.24 for thin and 1.92 for heavy), ps > .05. Infact a comparison of the scores of the post-training to the pre-training indicated that for the thin caricatures, the means were unchanged (M = 2.24 pre-training and 2.24 post-training). For the heavy condition, there was a slight but not significant improvement (M = 1.72 and 1.92) in their performance.

3.2 Discussion

This study had two goals. The first phase established a baseline of children's knowledge about the impact of physical and sedentary activities on body size. The second phase provided training to the same group of children and the third phase re-tested these children to determine if the training had any benefits. The results clearly demonstrated that children did not have a recognition like adults did of the impact of activities on body size and that the training did not have an impact on knowledge of activities on body size. Overall participants generated more 'correct' responses for the physically active activities than the sedentary activities. Interestingly, we did not obtain a significant grade x body size interaction mainly because adults generated significantly lower scores for the sedentary activities than the physically active activities. Adults seem to be more willing to acknowledge that physically active activities will keep you thinner but they are hesitant to acknowledge that engaging in sedentary activities will results in making a person heavy.

The results of this study have several implications both in terms of the child and adult data. First, children seem unable to benefit from the impact of teaching about the impact of activities in the preschool years. Interestingly, from previous research, they seem to have a better understanding of the impact of food on growth. This could be because parents tend to emphasize the impact of nutrition on growth more than the impact of activities on body size. Birch (1999) has documented parental input of the impact of nutrition on growth but we do not have any studies that have detailed the impact of activities on growth. Thus, there seems to be a conceptual hierarchy where repeated exposure to the impact of nutrition on growth has a positive effect. Second, the training that the children were given in this study might have been inadequate. A single exposure to the causal and associative links of the impact of activities on body size may not have been enough to enhance children's knowledge in this area. Similar to the domain of nutrition, preschoolers may need repeated input about the impact of activities on body size for long-term retention. Thus it would be helpful to replicate this study by (a) providing preschoolers daily training sessions between the pre-testing and post-testing sessions and (b) by testing the children in a shorter time span after the training session instead of waiting for a week between training and testing sessions.

It is also interesting that adults selectively associated physically active activities with being thin but did not associate sedentary activities with being heavy. This could be because some of the sedentary activities such as playing with Legos, playing the piano and reading have positive attributes and are seen as intellectually stimulating activities as opposed to other sedentary activities such as playing video games or watching TV. This suggests that

adults might attribute certain morally negative sedentary activities as being responsible for being overweight but do not make the same attribution to more intellectually stimulating sedentary activities (even though they are all sedentary and have similar outcomes on weight). Thus people who engage in these activities could be seen to be disciplined and intellectually motivated and thus they might also engage in physically active activities making them less prone to being heavy. So in other words, the data seems to indicate that adults attribute positive and negative valences to sedentary activities which in turn influences their reasoning about the impact that these activities have on weight.

4. General Discussion

The objective of the current paper was to determine if preschoolers and adults associate activities with body size. As stated earlier, weight is determined by multiple factors but one of the important determinants of weight is activities.

The most significant findings across the two studies is that preschoolers do not consistently associate activities with body size. Even though both studies had different approaches to examining this concept, the question this generates is why is it that preschoolers seem to have a better understanding of some biological processes such as the impact of nutrition on growth compared to their recognition of the impact of activities on growth? Apart from the fact that preschoolers are receiving more input about the impact of food on growth, conceptually it is more difficult to understand the impact of activities on growth. The food-growth relationship is an input-output process where food is the input and growth is the output whereas the impact of activities on growth is an output-output process where engaging in an activity is an output which results in the expenditure of calories which is another output. Since they are both output processes, it might be more challenging for preschoolers to understand this relationship.

Study 1 demonstrated that when participants were shown caricatures of heavy and thin boys and girls, they did not associate the sedentary activities with being heavy and physically active activities with being thin. Adults however associated sedentary activities with being heavy. Study 2 consisted of three phases. In the first phase, preschoolers and adults were presented with active and sedentary activities and asked is someone engages in those activities on a daily basis if they would be thin or heavy. As in Study 1, preschoolers did not consistently associate either active or sedentary activities with a particular body size. Adults however reasoned that a person who engages in active activities will be thin but a person who engages in sedentary activities will be heavy. In phase 2, preschoolers were given information using causal and associative links about the impact of activities on weight and in phase 3, the same group of preschoolers were tested on the same items that were presented in phase 1. The results from Study 2 replicate the results for the preschoolers in Study 1 but the results for the adults seems to be the opposite of what was found with the adult group in Study 1.

The results with the adult data in both studies generates the question as to why we are getting different and what seems like contradictory findings. There may be a few reasons for this. First, the methodology clearly is different for both studies but moreover the task in Study 1 is easier because it is more of a retrospective task where we know if the person is thin or heavy and then we are trying to associate which activities they engage in. In other words, we are trying to find an activity explanation as to why the person is the size he/she is. In Study 2, we are not presenting the thin or heavy person but instead we are asking participants to predict the body size of someone who engages in those activities. Predictions are harder since we can never be sure of the outcome. Thus participants know for sure that someone who engages in a strenuous activity will expend a certain amount of calories but when someone engages in a sedentary activities, it does not mean that they do not engage in a physically active activity. This makes it more difficult to predict the outcome for the sedentary activities. The fact that predictions are more difficult than explanations has been replicated in other domains (Legare, Wellman & Gelman, 2009). Second, the items we are using for the sedentary activities differs in Studies 1 and 2. For example, we used items such as ‘watching TV’ and ‘playing video games’ in Study 1 are often associated with a lazy character leading adults to associate sedentary activities with being heavy. In Study 2, the items that were used for sedentary activities were ones that are not associated with a deficient moral character (for example reading and playing the piano), leading adults to associate physically active activities to being thin but not associating sedentary activities to being heavy.

The results with the preschool data across both studies suggests that preschoolers do not recognize the impact of activities on weight. This has been replicated in other studies (Raman, in press) where it was not until middle childhood that children recognized this concept. Even though preschoolers were given information about the impact of activities on weight in Study 2, this did not translate into better performance. There could be a couple of reasons for this. First the temporal gap between teaching and testing (a week) might have been too long for children to retain this information. Second, they might needed to have multiple teaching sessions between phase 1

and 3 instead of just one session. Third, due to the limited input preschoolers get about the impact of activities on weight, it could be that preschoolers are conceptually not ready to recognize the impact activities have on weight. As they get older, they engage in more sports and thus by middle childhood learn more about the impact of activities on body size. Fourth, the impact of activities on weight is an output-output process where the expenditure of calories is an output and losing weight is an output (as opposed to the impact of food on growth which is an input-output process with food being the input and growth being the output. This output-output process might be difficult for preschoolers to understand.

Future studies could examine the psychological value we place on certain activities to determine if in fact there are what people think are positive and negative sedentary and physically active activities that influence how people think about the impact they might have on body size. In fact we saw some evidence of this in these studies where the sedentary activities in Study 2 were ones that adults in general view more positively than the sedentary activities in Study 1 thus making it harder for our adult participants to state that engaging in these sedentary activities would make a person heavier. Biologically in terms of expending calories, it should not matter if an activity is viewed positively or negatively but adults might put a more positive spin on sedentary activities like reading or painting that are viewed more positively than sedentary activities that are viewed negatively like playing video games or watching a lot of TV. The kind of sedentary activity that one engages in seems to be related to the moral character of that individual. Second, future research could focus on the kind of impact participants think a mixture of active and sedentary activities have on weight. In reality, most people engage in both sedentary and active activities rather than engage in just one or the other. Third, it would be interesting to conduct this research with populations that are medically deemed overweight or obese to determine if their perception of physical and sedentary activities on weight is different from non-obese populations. Fourth, it would be informative to determine if children evaluate physical activities or healthy foods more positively since both of them would contribute to a healthy weight. Also, it would also be useful to get parental input about which they deem harder to get children to do – engage in physical activities or eat healthy foods and which one of the two would parents focus on to get their children to achieve a healthy weight. Finally, participants could be presented with different proportions of physically active and sedentary activities to determine how children would reason about how mixed activities would impact weight.

There are some limitations to these studies. No specific demographic information was collected for these studies but the majority of the children came from White middle-class families. This could limit the generalizability of the results to White middle-class families. Second, physical activities were contrasted with sedentary activities but in reality most of us engage in a mixture of active or sedentary activities. Third, there are also other factors such as psychosocial stress and genetics that can contribute to weight gain that have not been considered in these studies. Lumeng et al., (2014) have found that psychosocial stress contributes to hypercortisolism which contributes directly to a higher likelihood of being overweight in girls due to reduced satiety responsiveness and emotional overeating in boys.

The results of these studies have reaffirmed that preschoolers struggle to recognize the impact of physically active and sedentary activities on weight. Given preschoolers' lack of recognition of the impact of physical activities on maintaining a healthy weight, there is an urgent need to emphasize the role of physical activities as being an important factor in maintaining a healthy lifestyle in early childhood education programs.

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