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Television Viewing Promoting Obesity in Children: Do We Really Know the Mechanism?

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Introduction

The link between television viewing and overweight and obesity in children has been reported for the first time in the literature, approximately 3 decades ago [1]. This relationship has been echoed in both cross-sectional [2], and longitudinal [3], studies throughout the past ~ 30 years. In some studies, screen time has been shown to be more strongly associated with obesity than moderate-to-vigorous physical activity (MVPA) [4]. Several mechanisms have been proposed to explain this relationship, and are discussed herein.

The displacement hypothesis

The concept of time use displacement with television viewing was identified in the 1960s, when television first emerged [5]. Television viewing has been shown to displace a number of activities, including homework and studying time [6]. The displacement hypothesis of television viewing suggests that an increase in the amount of time spent in this sedentary pursuit directly decreases the amount of discretionary time available for physical activity [5], thus decreasing daily energy expenditure, and leading to a positive caloric balance. This has been a dominant view in the field of sedentary behaviour and obesity research throughout the past decades. The notion that the link between television viewing and obesity is due to a relative lack of physical activity, can be seen in the editor's note of the paper by Gortmaker et al. [3]: "*The way to solve this problem is to rig all television sets to generators that must be powered manually—perhaps by a bicycle? Exercise would increase or viewing would decrease; it's guaranteed!* " We now know that television viewing time is not necessarily related to time spent in MVPA [5,7,8], and that low levels of screen time do not necessarily predict high levels of MVPA [9]. The displacement hypothesis seems an unlikely candidate as a mechanism for explaining the relationship between television viewing and obesity, as children can be 'active couch potatoes'–they can obtain both high amounts of sedentary time, as well as high amounts of MVPA throughout the day [10]. Furthermore, if the association between television viewing and obesity is solely due to the sedentary nature of television viewing, then we would expect that total sedentary time would be associated with obesity in children; however, this has not been shown to be the case in many studies [11]. Recently, Mitchell et al. [12] found that total sedentary time was associated with an increase in body mass index (BMI), but only after adjusting for time spent in MVPA.

Reduction in resting metabolic rate

It is said that television watching may decrease a child's metabolic rate [13], thus leading to a decrease in total energy expenditure and a positive caloric balance. The evidence to support this mechanism is however limited. Klesges et al. [14] found that the metabolic rate of children was lower when they were watching television than when they were at rest. However, Dietz et al. [15] found that resting metabolic rate did not change with television viewing, as compared to reading or sitting quietly, which is consistent with findings in adults [16]. Dietz et al. [15] also found that children tended to fidget more when they were sitting quietly, than when they were reading or watching television [15]. Further research is needed to rule out whether or not a reduction in metabolic rate seen with television viewing has anything do with television viewing itself, or with a lack of fidgeting with children being occupied by other activities. While this potential mechanism cannot be ruled out as a potential explanation, at least in part, for the relationship between television viewing and obesity in children, caution should be exercised in interpreting these results, until more evidence is available.

Television content and food choices

Television viewing differs from other sedentary behaviours, in that it offers an avenue for food marketers to advertise their products to potential consumers. In fact, in 1990, food advertisements constituted 9.6 minutes of programming time per hour in the United States [17]. In 2005, out of 275 foods advertised during children's television programs, 83% were convenience/fast foods or sweets, and between-meal snacking was depicted more often than breakfast, lunch, and dinner combined [18]. While television advertisements have the capacity to influence food choices and preferences, in order to influence obesity these preferences must be acted upon-children must actually consume these foods. Television advertisements have been shown to increase total food intake, by up to 45% in children in experimental studies [19]. Furthermore, food intake has been shown to increase for each additional hour of television watched [2,20], and children who watch more television were more likely to consume sweets and soft drinks, and less likely to consume fruits and vegetables [21,22]. This is not surprising, as a number of sedentary behaviours have been associated with an overconsumption of food in our current obesogenic environment [23,24]. While television watching has been shown to increase food intake throughout the whole day, food intake has also been shown to increase, while children are watching television.

Increased food intake through between-meal snacking

Eating in front of the television has been suggested to be one of the major mechanisms behind the relationship between television viewing and obesity in children. Up to 26% of total energy intake may be consumed in front of the television [25]. Furthermore, intervention studies have shown that reductions in sedentary behaviour can lead to reductions in BMI z-scores, and that this may be mediated by less food intake, rather than more MVPA [26]. Increased food intake while watching television is thought to be driven by several

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distraction mechanisms: an attention allocation to TV stimulus [27,28], habituation to food cues through food [29], and non-food stimuli [30], and distraction leading to delayed and reduced satiety signals [27]. As noted by Thivel et al. [23], there is currently no definitive evidence to understand, how children who are overweight/obese or of normal weight may differ in their food intake patterns in front of the television. In a society where television viewing is ubiquitous, alongside other obesogenic behaviors and environmental factors, a reduction in the frequency of food consumption in front of the screen, may go a long way in the prevention of obesity in children.

Conclusion

Television viewing may represent an important area of intervention for the prevention of obesity in children. There are four proposed mechanisms underlying the relationship between television viewing and obesity in children: 1) the displacement hypothesis, 2) reduction in resting metabolic rate, 3) television content and food choices, and 4) between-meal snacking in front of the television. The popular notion that television viewing causes obesity through a displacement of physical activity is not supported by the available evidence. Additionally, there is very little evidence to conclude that television viewing is associated with a reduction in resting metabolic rate, at least beyond that seen with other sedentary behaviors. However, the literature supports the latter 2 mechanisms, in that television content does influence food choices in children, and that distraction mechanisms while watching television may promote increased caloric intake through between-meal snacking. Future research should focus on how children who are overweight and obese differ from their normal-weight counterparts in their television viewing and associated food intake patterns. Moreover, intervention studies looking at the influence of reducing television viewing time on daily food intake should examine whether the effect is similar or not between obese and lean children. Given that television viewing is pervasive in modern societies, efforts aiming to minimize the adverse effects of this sedentary behaviour on health are warranted.

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