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Category of Paper: Original research paper.

Article Title: Real Life Active Gaming Practices of 7-to-11 Year-Old Children.

Author Names: Susan Allsop^a,
Penny Louise Sheena Rumbold^a,
Dorothee Debuse^a,
Caroline Dodd-Reynolds^a

^aDepartment of Sport, Exercise and Rehabilitation, Faculty of Health and Life Sciences,
Northumbria University, Northumberland Building, Newcastle upon Tyne, NE1 8ST, UK.

Running Title: Children's real life active gaming practices.

Abstract

Objective

In the laboratory, active gaming has been shown to increase physical activity levels in children compared with seated media activities. The information is sparse however, about children's real-life active gaming practices and the laboratory protocols utilised thus far might not be representative. The purpose of the present study was to establish the socio-demographic characteristics, real life active gaming practices and reasons for game-play, to later inform intervention studies.

Materials and Methods

An 'Active Gaming Questionnaire' was purposely developed and distributed to 44, 7-to-11-year-old children and their parents. Forty questionnaires were completed and returned.

Results

Analysis found 95% of the children had access to active gaming consoles 'at home'. The favourite console was Nintendo Wii™ and favourite game Nintendo Wii™ Sports. The majority of children frequently played active games against other people. The average reported game-play time was 81 minutes on 1-to-2 days per week, usually on a Saturday. More than half of the children (52.5%) consumed foods and/or drinks during play which was significantly associated ($p=0.000$) with an extended average game-play time (81 minutes). The majority of participants (65%) considered active gaming to be an alternative form of exercise and main reasons for active video game-play included for entertainment, health benefits and the environment.

Conclusion

In conclusion, children aged 9.3 (± 1.4) years, typically play Nintendo Wii™ Sports, once or twice per week for 81 minutes. Reported active game-play time is extended by 25 minutes when food and/or drinks are consumed.

Introduction

In England, one third of children are either overweight or obese and only 32% of boys and 24% of girls aged between 2 and 15 years are meeting the recommended 60 minutes of moderate-to vigorous physical activity per day. A large proportion of their time is also spent being sedentary with an average of 3.4 hours on weekdays, increasing to 4.1 hours for boys and 4.2 hours for girls on weekends.¹ In the UK, seated computer games are very popular with 100% of 6-to-10 year-olds regularly playing them² so these might be partly attributable to the low levels of physical activity.³ Unhealthy food consumption and lower intakes of fruit and vegetables have been linked to seated media activities so alongside low physical activity levels, could contribute to childhood positive energy imbalance.^{4,5}

Active games are a relatively recent addition to the computer gaming market and could provide a way to increase children's physical activity in the current technology driven society.^{6,7} They require the player to move their body to physically interact with on-screen images, enabling them to dance or to play games that are intended to replicate sports. Recent laboratory-based investigations have found that children expend two to three times more energy by playing the Nintendo Wii™ Sports boxing game, compared with watching television or playing seated video games.⁸⁻¹¹ Children have also reached five metabolic equivalents (METs) playing Eye Toy Knockout (PlayStation® 2) which is comparable to moderate levels of physical activity.^{12,13} The variability in energy expended and physical activity level achieved however, may be dependent upon the console and game played and the laboratory protocol. The range of laboratory protocols utilised are unlikely to resemble children's real life active gaming activity especially when considering adolescent active game-play. In Canada, adolescents reported playing for 50.5 minutes per bout¹⁴ whilst in The Netherlands their game-play is once per week for an average of 80 minutes¹⁵. It would

therefore, be beneficial for actual active game-play time to be established prior to the design of active gaming intervention studies.

Active game-play might also be affected by socio-demographic characteristics. Indeed, there are data regarding the socio-demographic and active gaming patterns for adolescents in The Netherlands and Canada. Being of a younger age was found to be associated with more frequent active game-play in Dutch adolescents whilst in Canada, females were more likely to play these games than males.^{14,15} Information such as this in the UK on which to successfully inform intervention studies however is lacking. There is also limited understanding of the reasons for children's active game-play, which might be dependent upon the study population.^{16,17} In New Zealand, children reported the content of some active games motivated their play¹⁷. They are also viewed as being a more social form of computer game than non-active games as they enable game-play against others^{15,17,18}. Indeed Chinapaw and colleagues (2008) found an increased motivation to play when children played against other players which was believed to have reduced drop-out rate in an active gaming intervention¹⁹.

When also considering the evidence of unhealthy food intake during sedentary media activities⁴ and the similarity in food intakes found in 9-to-13 year-old children during laboratory-based bouts of both seated and active gaming,²⁰ it is of interest to explore whether children habitually consume foods or drinks in their naturalistic environment during active game-play and if so and what these foods and drinks are.⁵

Effective approaches are needed to tackle children's low physical activity and unhealthy food intakes as these are the major contributors to positive energy imbalance in children.²¹ Active games might be one such approach however, the majority of the research thus far has been laboratory-based and is not necessarily representative of active gaming

practices in real life, of young children. Therefore, the primary aim of the present study was to establish the real life active gaming activity of 7-to-11 year-old children from Newcastle-upon-Tyne. Secondly, to obtain the socio-demographic characteristics of the children who play active video games within the locality. Thirdly, to explore any food and/or drink consumption during active game-play and lastly to ascertain reasons why active games were played.

Methods

Design

A cross-sectional study design was employed. The study was approved by the University of Northumbria, Faculty of Health and Life Sciences Ethics Committee.

Participants

The study population was acquired through primary schools located in Newcastle-upon-Tyne, a City within the North East of England (UK). To gain access to 7-to-11 year old children, fifteen primary schools were approached from areas within the city which varied according to Indices of Multiple Deprivation.²² Written informed consent was obtained from three of these schools. Recruitment took place during the spring and summer school terms (from 10th April 2012 until 6th July 2012) either during class time or at school events such as summer fayres. This enabled access to 310 children aged from 7-to-11 years and their parent, from which a criterion sample whom had access to play active games, were invited to take part. Children who did not have access to play active video games, were excluded. Prior to data collection, written informed consent was obtained from 44 children and their parent or guardian from the three consenting schools. Forty four questionnaires were distributed to consenting participants in these schools and 40 were completed in full and returned.

Study Measures

The Active Gaming Questionnaire was purposely developed to establish the real life active gaming activity and socio-demographics of the study population. Due to the young age of the children, the parent was asked to answer the questions with their child's input. The questions within the Active Gaming Questionnaire are reported in Table 1. Multiple choice questions were mainly utilised to reduce the burden of time upon the participants and to increase response rate. Although a small number were open-ended to enable the participants the freedom to provide unbiased and instinctive responses.^{23,24} The questionnaire begins with some general questions relating to the type of console and game played and the kind of access to these. Remaining questions were developed using primary research. Questions 7, 8 and 9 were based on those used in the International Physical Activity Questionnaire (IPAQ, 2001) to establish the frequency of the child's active video game-play during the last 7 days. Questions 10 and 11, were devised due to findings that children had increased motivation to play active games when they played against others.¹⁶ The lack of difference found in children's energy intake (EI) between seated and active video game-play, was the reason for questions 12, 13, 14 and 15.²⁰ Question 16 was developed from previously reported parental concerns of prolonged sitting during their children's seated computer game-play and subsequent reduction in outdoor activity.¹⁸

Specifically, the questionnaire was designed to establish (i) the socio-demographics of the study population and in terms of real life active gaming practices, (ii) the types of consoles and games the children played most frequently (iii) the type of access the children had to active games (iv) the frequency, duration and mode of active game-play (v) any food and/or drink consumption during active gaming and (iv) the reasons for active game-play. Prior to data collection, pilot testing was carried out to confirm participant comprehension of questions and ensure the information acquired from the questionnaire met the study aims.

Data Analysis

The statistical package SPSS-PC (Version 19; SPSS Inc., Chicago, IL) was used to analyse the responses to the closed questions within the Active Gaming Questionnaire as these variables were either dichotomous or categorical apart from usual time (in minutes) of game-play which was continuous, as illustrated in Table 1. Shapiro-Wilk tests revealed all the data was not normally distributed. The data for usual active game play time was therefore log transformed. Descriptive statistics (frequencies and means) were implemented to establish the socio-demographics and the real life active gaming practices which comprised, the consoles and games played most, the type of access to active games, the frequency, duration and mode of the children's game-play and to also determine whether foods and drinks were consumed during active game-play. Associations were then checked between the real life active gaming practices and the 'yes or no' response to whether foods and/or drinks were consumed during play using Chi-square. Differences in game-play time according to whether food and/or drinks were consumed were explored using an Independent sample t-test.

The responses to two open-ended questions which established reasons for active game-play were transcribed verbatim and read through several times in order to become familiar with their content. Thematic analysis allowed the qualitative data to be explored for recurring themes so that it could be categorized and organised in a meaningful way.²⁵

Results

Socio-demographic Characteristics

The majority of children who participated were boys (n=29, 72.5% vs. n=11, 37.5% girls). The mean (\pm SD) age of boys (9.0 ± 1.3 years) and girls (9.5 ± 1.5 years) was similar. The children were mainly white (n=36, 90%), followed by Asian (n=3, 7.5%) and mixed ethnicity (n=1, 2.5%).

Habitual Active Gaming Patterns

A total of 95% of the children had access to an active gaming console 'at home'. Fifty per cent of them had access to an active gaming console only 'at home' whilst 45% not only had access 'at home' but also 'at a friend's home', 'at a relative's home' or elsewhere. Five per cent of the children had access only 'at a friend's home'. The most popular device played was the Nintendo Wii™ although a large proportion of the children (55%) played more than one type of active gaming console. Nintendo Wii™ Sports was the favourite and most frequently played game, followed by Just Dance® and Microsoft© Kinect Adventures.

During the preceding 7-days, the average frequency of active game-play was '1-to 2-days', with Saturday being the day on which the majority of children (55%) played most. The mean time of the children's active video game-play was 81 ±50 minutes. Most children (97%) played active games with other people, generally their 'brother/s or sister/s'.

Food and Drink Intake during Active Gaming

More than half of the participants ate and/or drank whilst they played (52.5%). The foods and drinks that were reported as being consumed by the children are listed in Table 1. The most popular foods were fruit (13%) and potato chips (13%) and the most popular drinks were fruit flavoured juice (45%) and milk (10%). On average the children who ate and/or drank whilst active gaming, played for 82 ±68 minutes which was a significantly greater game-play time than for those who did not eat or drink during play (57 ±32 minutes) ($p=0.00$). Chi-square analysis found no associations between the consoles and games played most, the type of access to active games or the frequency and mode of the children's active game-play and whether they ate and/or drank during game-play.

Reasons for Active Video Game Play

When asked if they believed active games were an alternative form of exercise for their child, a large proportion of the parents responded “yes” (65% vs. “no” = 32.5% and “don’t know” = 2.5%). Chi-square analysis revealed a significant association between whether parents considered active games to be an alternative form of exercise and the consumption of foods and/or drinks during play. Those who responded that they did consider active gaming to be an alternative form of exercise (65%), 73.1% of them also reported that their children consumed foods and/or drinks during play. Whilst out of those who responded ‘no’, they did not consider active gaming to be an alternative form of exercise (32.5%), 84.6% reported that their child did not eat and/or drink during play ($\chi^2 = 12.494$, $df = 2$, $p = 0.00$).

When asked to give a reason for their response (‘yes’ or ‘no’) as to why they believed active gaming was or was not an alternative form of exercise for their child, three themes emerged from the thematic analysis. These were ‘*physical effects*’, ‘*outdoor games and play*’ and ‘*environment*’. ‘*Physical effects*’ was the most common theme to emerge. Those who considered active games to be an alternative form of exercise recognised beneficial effects such as good hand-eye coordination and an increase in breathing rate when their child played them. Whilst those who considered active games were not an alternative form of exercise viewed the *physical effects* observed from active game-play as not so beneficial and believed they were insufficiently physically demanding. Active games however, were generally not regarded as being a complete replacement for ‘*outdoor games and play*’ with several parents reporting they preferred their child to play outside. Responses relating to the ‘*environment*’ revealed that active gaming was regarded as a good alternative when the weather restricted outdoor play. For some parents, they were considered an alternative form of exercise due to a lack of safe green space in which to play.

In response to ‘please give a main reason why your child plays active video games’, four themes emerged from thematic analysis and were labelled ‘*entertainment*’, ‘*health*

benefits, *popularity* and *unsafe environment*. *Entertainment* was the most common theme to emerge. The majority of parents reported that their child played them for fun and enjoyment. Some parents reported that their child played them because they believed the movement needed for game-play was beneficial to health. Others viewed the *popularity* of active games amongst peers, as the main reason their child played them. Finally, some parents perceived their surrounding area as being an *unsafe environment* which inhibited outdoor play and thus facilitated their child's active game-play.

Discussion

The primary aim of the current study was to establish the real life active gaming activity of young children (7-to 11-years) within a specific locality in the UK. To obtain socio-demographic characteristics, explore any food and/or drink consumption during active game-play and to ascertain reasons why they play active games.

In the present study population, there were similarities found with active gaming practices in other paediatric populations. The children had easy access to active gaming consoles and games at home, as do New Zealand children¹⁷ and Canadian and Dutch adolescents.^{14,15} As with the Canadian adolescents, the children preferred the Nintendo Wii™ console and Nintendo Wii™ Sports game compendium.¹⁵ In previous laboratory-based investigations this particular console and game has increased children's energy expenditure (EE) by two to three times, when compared with resting and sedentary media activities.^{8,13,26} Such EE is equivalent to exercising at a moderate level of ≥ 3 to < 6 METs as achieved in structured activities such as walking, skipping, jogging and basketball.²⁷

Most of the children play active games against others which infers that they view them as being a social activity, akin to Dutch children and parents.^{15,18} They also use them as a form of *entertainment*, see them as being *popular* amongst their peers and observe

physical effects from game-play which are perceived as having *health benefits*.²⁸ Considering the current low levels of physical activity in children in England and the good accessibility of active games, they could be employed to help meet current physical activity guidelines by encouraging greater play. Greater active game-play might also help to reduce any potential health inequalities for those children who play them due to a lack of safe or unsuitable green space in their surrounding *environment*.²⁹⁻³¹

Similar to Dutch adolescents, the frequency of game-play is not a high level in the present study population.¹⁵ Most of the children had played on only “1 or 2 days” during the preceding 7-days. Their active game-play was mainly on a Saturday for an average of 81 minutes, a duration comparable to that of Dutch adolescents at 80 minutes per week.¹⁵ When considering the current physical activity guidelines in the UK¹, and assuming these children played active games at a moderate intensity and did not engage in any other physical activity, their active game-play would only help to meet the recommended levels on 1-day per week. The frequency of active game-play is therefore, insufficient to meet weekly physical activity guidelines.^{15,16} One reason for such low frequency of active game-play in the present population could be a preference for *outdoor games and play* as also favoured by 13-to-14 year-old New Zealand boys.¹⁷

In the present study, children who consumed foods and/or drinks during active gaming reported a significantly longer play time in comparison to those who did not. The additional energy expended by active game-play could be counterbalanced by this EI. Then again, the EI could be in excess of the energy expended, as observed in a laboratory intervention with 9-to-13 year-olds who consumed as much food during active game-play as they did whilst seated gaming.²⁰

To date, both EI and appetite during active gaming has only been examined in adults.³² Here Lyons and colleagues (2012) found EI to be lower during active gaming versus both television watching and seated gaming whilst EE was significantly greater. More energy was still ingested however, than expended.³² Thus suggesting that even though the children in the present study who reported eating and/or drinking during gaming play for longer, their EI during active game-play could contribute to childhood positive energy imbalance and associated health inequalities^{5,6} however, this requires further exploration. For those whose *environment* is perceived as unsuitable for outdoor play, EI during active game-play might increase the risk of positive energy imbalance.³¹

The strengths of the current study were that it was the first investigation within the UK to examine the real life active gaming activity of 7-to-11 year old children and present reasons why these children play active games. The study population was however purposefully selected to be children who played active games in a specific locality and so findings should not be generalised to other populations. A limitation of the investigation is that some of the survey questions could not be validated as they were specifically developed for the current study. The questions were however, pilot-tested in a matched population to check their understanding and that responses met with the study aims. All participants provided self-completed responses to the two open-ended questions although some of these were noted to be short and cryptic. The qualitative information obtained here could have been enhanced had interviews been conducted, enabling interviewers to probe for more comprehensive information. Although the size of the sample is small, a main finding was that the reported average active game-play was significantly increased by 25 minutes when children ate and/or drank during play ($p=0.03$). The beneficial change observed however was 0.9 and so greater than the recommended 0.88 (Hopkins, 2006).

A further limitation was that the findings and analysis were dependent upon self-report data. The frequency and duration of active game-play were therefore, not determined objectively and might have been overestimated by participants.^{33,34} Future investigations might consider measuring frequency and duration objectively by using accelerometry, to gain a more accurate depiction of the real life active gaming activity of the study population, as previously demonstrated by Baranowski and colleagues (2012).¹⁶ Despite such limitations, we have provided a foundation and rationale for further work to explore EI and subjective perceptions of appetite during both active and sedentary gaming in children. Particularly given the high proportion of children found to consume foods and/or drinks during active game-play, and the associated extended gaming time reported. The consumption of food and/or drinks whilst active gaming might also be comparable to intakes during seated gaming, as shown by Mellecker and colleagues (2010). The further work will therefore enable any effect on energy balance from food and/or drink consumption during active game-play in children to be explored utilising a more free-living, ecologically valid study design, as demonstrated in our latest paediatric exercise and appetite research.³⁵

In conclusion, the children in this study typically play Nintendo Wii™ Sports, once or twice per week for 81 minutes. This frequency of active game-play would need to increase per week to help meet physical activity recommendations. The duration of game-play was increased by an average of 25 minutes when food and/or drinks were consumed whilst gaming which might have implications on childhood energy balance. Such information can be used to better inform future active gaming intervention study designs, where a high degree of ecological validity is required.

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Author Disclosure

The authors declare that there are no associations that pose real or perceived conflicts of interests and there are no competing financial interests.

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Contact details for correspondence:

Susan Allsop, Email: s.allsop@northumbria.ac.uk

Penny Rumbold, Email: penny.rumbold@northumbria.ac.uk