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What is the relationship between binge-watching, physical health and physical activity?

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Table of content

Table of figures

1 Abstract

Title: What is the relationship between binge-watching, physical health and physical activity?

Introduction: In recent years, increasing popularity of "binge-watching", a phenomenon referring to watching multiple TV episodes within one session, has led to questions regarding it's impact on health. This study aims to investigate the relationship between binge-watching, physical health as well as physical inactivity, which was identified to be one of the main mortality risks worldwide.

Methods: A cross-sectional online survey design was employed and the study was conducted among university students. 127 participants answered four questions about their binge-watching behavior and next to that, two questionnaires about physical health and physical activity were applied. Data was then analyzed using IBM SPSS Statistics 24 and applying descriptive statistics as well as Pearson´s correlational analysis.

Results: Two significant, but weak correlations were found. Increased use of online streaming services was related to a decreased physical activity score (r=-.179) as well as to increased physical health complaints (r=.212). The relation between the number of episodes watched and physical health was negative (r=-1.47), and for physical activity it was positive (r=.097), but they were both non-significant.

Conclusion: It can be concluded that there is a relationship between binge-watching, physical health and physical activity. However, the design of the study does not allow to draw causal conclusions and the correlations found were weak. Therefore, much more research is still needed. Especially because binge-watching has become a common way of spending leisure time for many people, it is important to further investigate the phenomenon of binge-watching and to find solutions for the health issues that came up.

2 Introduction

Development of media

Online streaming services have been expanding very fast in the last few years (Flayelle et al., 2020). In America, more and more television series have been produced as the number has doubled from 46 million to 93 million between 2015 and 2016. Two of the biggest streaming websites are Netflix and Amazon, which play a major role in the global mediascape. They present themselves as a replacement for traditional television networks through which the subscribers can get access to a wide range of content matching their personal interest. Thus, these streaming services are not tailored to a specific audience. More than 180 million people worldwide make use of either Netflix or Amazon (Wayne, 2017). In the United States in 2013, 63% of the households used a video streaming and delivery service like Netflix, and 22% of those households were watching series or movies every single week of the year (Pittman & Sheehan, 2015). The viewers are given the choice to decide themselves how and when to watch their series, which enhanced a new phenomenon called "binge-watching" (Pena, 2015). Hence, twenty-first century media consumption has been characteristic for the shift from traditional media to binge-watching and the development of online streaming services (Wayne, 2017).

Definition of binge-watching

In general, binge behavior of any kind can be associated with an extreme, devoted and very time-consuming experience. The amount of time, frequency, and the level of engagement may be important indicators of binge-watching (Sung, Kang, & Lee, 2018). Binge-watching can be defined as watching multiple episodes of a TV series in quick succession and it has become very popular when Netflix uploaded an entire season instead of only one episode at once (Flayelle et al., 2020; De Feijter, Khan & Van Gisbergen, 2016). Netflix itself defined binge-watching as "watching between 2-6 episodes of the same TV show in one sitting" (De Feijter, Khan & Van Gisbergen, 2016). However, there are several other definitions, but they all have in common that binge-watching refers to watching episodes of the same program for several straight hours in one sitting (Sung, Kang & Lee, 2018). In a recent study by MarketCast it was concluded that 67% of viewers aged between thirteen and forty-nine admit to binge-watch sometimes (Matrix, 2014). But why do more and more people select this new alternative of entertainment (Pittman & Sheehan, 2015)?

Causes for binge-watching

Binge-watching has become very popular especially among younger people, but what are the exact motives and purposes behind engaging and continuing this behavior (Dandamudi & Sathiyaseelan, 2018)? Firstly, it requires very little effort to binge on an online streaming website like Netflix because Netflix exerts an opt-out system (Pittman, & Sheehan, 2015). This means that after having finished one episode of a series, the next one will automatically start, unless the user actively stops it. Hence, it takes more effort to stop watching than to continue. Additionally, Netflix makes use of a recommender system and algorithms, which enable that users only see the content they are likely to enjoy (Pittman, & Sheehan, 2015). Besides, Netflix gives people the freedom to watch what and whenever they want. It makes use of complex narratives and interesting characters as well as cliffhangers which keeps the attention of the audience episode after episode (Matrix, 2014). Moreover, people can identify with the main characters in the storyline and throughout the series they may build up a relationship with them. Thus, their attention is kept, as they feel related to the protagonists (Flayelle et al., 2020). Secondly, by making use of streaming services like Netflix, the subscribers are able to participate in cultural conversations about popular movies and series (Matrix, 2014). If people do not watch, they might be unable to exchange with others. That leads to the phenomena "fear of missing out", meaning that people have the need to binge-watch, just because they do not want to feel excluded when others are talking about a series they are watching (Matrix, 2014). Lastly, younger age has been positively associated with binge-watching, its frequency, and also problematic series watching (Flayelle et al., 2020). Young people seem to primarily look for inspiration and, in some cases, also for maturity, when watching series or movies provided by online streaming services. Moreover, watching adult programs can satisfy the intellectual curiosity of the younger viewers and it may also teach them how to be themselves, and how to set interesting new goals. Some teens also reported that they feel comfortable and relaxed when binge-watching (Matrix, 2014; Flayelle et al., 2020). To sum up, reasons for binge-watching are related to the characteristics of streaming sites, to social relationships with others and to younger age groups.

Consequences of binge-watching

Emotional Consequences

There has been concern about prolonged TV viewing because of possible negative consequences, which are explained in the following (Matrix, 2014). The amount of time spent watching a series, plays an important role in the effect of binge-watching on emotional

wellbeing (De Feijter, Khan & Van Gisbergen, 2016). High-levels of binge-watching have been found to be linked with trying to deal with loneliness as well as escaping from everyday life and everyday worries. Users are motivated to pass time in order to feel distracted from their real life (Ahmed, 2017). High-frequency of binge-watching has also been associated with the need to regulate emotions.

Besides, binge-watchers are more likely to experience a decrease of meaningful and positive effect after a show ends, which led to the suggestion that viewers may feel empty after having watched all seasons of a series (Flayelle et al., 2020). Ahmed (as cited in Petersen, 2016) reported that people try to create feelings of happiness, when thinking about their favorite show during the day. They see binge-watching as a form of reward after hard work, or after having a stressful day. Furthermore, people reflect that excessive TV watching has absorbed and sucked out the energy of them and after viewing people often have difficulty to concentrate on anything else (Kubey & Csikszentmihalyi, 2002).

Additionally, binge-watching can lead to an inner conflict, because if people binge-watch, they often postpone other tasks they need to do. It was found that high-frequency of binge-watching has been associated with procrastination (Flayelle, et al., 2020). It is likely that this results in negative feelings, especially feelings of guilt (Granow, Reinecke & Ziegele, 2018). Next to these emotional consequences, research has also shown that binge-watching can negatively affect the user´s physical health.

Physical consequences

Binge-watching has been linked to reduced sleep quality, resulting in daytime fatigue and insomnia (Flayelle et al., 2020). Besides, binge-watching was connected to sleep disturbances, lack of sleep, and alterations in melatonin levels (Sigman, 2007). Furthermore, binge-watching can be related to weight gain (Must & Tybor, 2000) and in addition to that, research has shown that watching a lot of television increases the risk of obesity by 23% (Must & Tybor, 2000; Hui, Li, Colditz, Willet & Manson, 2003). Another reason for the increased risk of weight gain is that watching series for a long period is often connected to the intake of unhealthy food, meaning that people are most likely to eat food that is high in fat and carb (Thorp, Owen, Neuhaus & Dunstan, 2011; Robinson & Killen, 2001; Coon, Goldberg, Rogers & Tucker, 2001). Research has also indicated that prolonged television exposure has been associated with a higher risk of cardiovascular disease and type 2 diabetes (Grøntved & Hu, 2011). 60% of deaths worldwide are caused by cardiovascular disease, cancer, diabetes and respiratory

disorders. Risk factors associated with these diseases are for example unhealthy diets, physical inactivity and obesity (Cecchini et al., 2010).

With the increased rates of binge-watching, concerns about physical inactivity resulting in health risks came up (Matrix, 2014). More and more people choose to stay inside and watch TV instead of going out and getting physically active (Biddle, Gorely, Marshall, Murdey & Cameron, 2004). 33% of men and 45% of women in the UK do not achieve recommended physical activity levels (Geneva, World Health Organization, 2009). Adults between 18-64 should do at least "150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity" ("Physical Activity and Adults",2020). In Germany, there are even more people (54%) who fail to reach the recommended physical activity level ("Germany Physical Activity Factsheet 2018", 2018). It was estimated that physical inactivity causes approximately 21-25% of breast and colon cancer burden, 27% of diabetes and 30% of ischaemic heart disease burden (Geneva, World Health Organization, 2009).

A study by Biddle, Gorely, Marshall, Murdey & Cameron in 2004 investigated the effect of sedentary behavior on well-being, by focusing on possible health consequences. Besides, Grøntved and Hu (2011), have tried to find a relation between prolonged TV watching and the risk of getting type 2 diabetes, cardiovascular disease and all-cause mortality. However, as research has mainly focused on consequences of sedentary behavior like watching television in general, little is known about physical health consequences of binge-watching (Matrix, 2014; Pittmann & Sheehan, 2015). It was recently found, that binge-watching can be related to all of the above-mentioned risk factors for developing one of the diseases that cause 60% deaths worldwide (Waltson-Pattinson, Dombrowski & Presseau, 2016). Hence, this study could contribute to a better understanding of how exactly binge-watching is related to the physical health of people. Moreover, a lack of physical activity is a main mortality risk factor, and therefore it was also included in this study (Groshek, Krongard & Zhang, 2018). The aim of the study is to analyze the relationship between binge watching, physical health, and physical activity.

3 Methods

3.1 Design

A cross-sectional online survey design was employed. This design was chosen because it makes it easy to investigate a possible relationship between variables and to perform a correlational analysis.

3.2 Participants

The study was conducted among university students. In total, 127 students filled in the questionnaire, aged between 18 and 28 (M=21.5; SD= 1.54). Further characteristics can be viewed in *Table 1*. Participants were recruited by convenience sampling, wherefore each of the researchers shared the survey with friends and other acquaintances via an anonymous link on social networks like Facebook, Instagram and WhatsApp. Moreover, the study was published on Sona systems, where it was made available for students in psychology or communication studies. Sona Systems is a network of the University of Twente, where current Bachelor or Master studies are published and students can earn credits when participating. Inclusion criteria for students were to be able to understand English since the survey was completely in English. Besides participants were expected to already make use of online streaming services like Netflix or Amazon in their leisure time because a main aspect in the study was to investigate a possible correlation between binge-watching, physical health and physical activity. Participation in the study was on a voluntary basis.

Table 1. Sample characteristics (N=127)

Variable	Frequency	%
Age in years, mean (SD)	21.5 (1.54 SD)	
Gender		
Male	44	34.6
Female	83	65.4
Nationality		
German	119	93.7
Dutch	5	3.9
Other	3	2.4
Education		
Bachelor student	119	93.7
Master student	8	6.3

3.3 Materials

The online survey was constructed and distributed via the platform Qualtrics. The survey included questions about respondents´ demographics, their watching behavior, physical health, and physical activity.

To gain information about the demographics, a questionnaire about the participant´s gender, age, education level, and nationality was employed. To get insight into the watching behavior of the participants, four different questions were asked. The first one was "How often do you use streaming services? (e.g. Netflix, Amazon Prime etc.)" and participants had five different response options: less than once a week, once a week, 2-3 times a week, several times a week, and every day. The second question was "On average, how many episodes do you watch in one setting?" and the participants were supposed to fill in a number. The third question was again a multiple-choice question and was about the hours per day that are on average spent with watching video on demand. Participants had to decide between the options: less than one hour, one hour, two hours, three hours, four hours, five hours, six hours, seven hours or more than seven hours. The last question "On average, how many hours do you spend watching Tv per day?" and the same response options were provided like in the third question.

To measure respondents´ physical health, two different questionnaires were employed. The first one "Patient Health Questionnaire" (PHQ-15) (Van Ravesteijn et al., 2009) was used, which consisted of 15 questions about physical symptoms of the participants. Participants were asked to indicate how much they have been bothered by problems like stomach pain, dizziness or headaches and they had to make a decision between the following response options: not bothered at all (0), bothered a little (1), and bothered a lot (2). By adding up the given answers, the severity of the physical symptoms was calculated ranging from minimal symptoms to high symptoms. Higher scores were indicating greater severity of the symptoms. Total scores between 0-4 can be categorized as minimal. Scores between 5-9 fall into the category low. Scores from 10-14 can be categorized as medium and a total score from 15-30 is indicative for high levels of somatic symptom severity. In this study, Cronbach´s alpha was found to be .75, which is acceptable. In a study by Van Ravesteijn et al., (2009) the PHQ-15 demonstrated good internal consistency (Cronbach's alpha = .80). Moreover, sensitivity was found to be 78% and specificity 71% at a cutoff level of three or more severe somatic symptoms. The test-retest reliability was .6 and thus, the PHQ-15 could be used as a reliable and valid tool for the detection of physical symptoms (Van Ravesteijn et al., 2009).

The second questionnaire "Godin-Leisure-Time Exercise Questionnaire" (Amireault & Godin, 2015) was used in order to find out about the physical activity of the participants. Respondents were asked to indicate during a typical 7-day period how many times on average they do different kinds of exercises for more than 15 minutes during their free time. The questionnaire is made up of three different categories: strenuous exercise, moderate exercise and mild/light

exercise. Participants had to fill in how many times they do the different kinds of exercises and the amount was multiplied with either 9, 5 or 3 to get the total score. Strenuous exercises were for example running, jogging or football, where your heart beats rapidly. Examples for moderate exercise were fast walking, or easy bicycling, which should not be exhausting for one. Mild or light exercise only takes minimal effort and an example would be easy walking or yoga. Based on the total score, participants were classified into the categories active, moderately active and insufficiently active/sedentary. A total score that ranges from 0 to 14 units, can be categorized as insufficiently active/sedentary. A score from 14-23 units is indicative for the category moderately active and a total score that is higher than 24 units falls into the category active. Concerning reliability and validity, for a 15-day period, a k coefficient of .65 and for a 30-day period a k coefficient of .45 was found. The percentage of agreement between test and retest was found to be 72%. Concerning validity, a post hoc analysis has indicated that for example 22% of variance of the variable maximal oxygen consumption could be explained by the Questionnaire. Thus, reliability and validity were satisfactory (Amireault & Godin, 2015).

3.4 Procedure

The research was conducted with two other students who were studying a different research question, but on the same topic binge-watching. Data was shared with each other and in the end, everyone had 127 participants. Before starting with the actual data collection, ethical approval was requested and thereupon sustained by the ethical committee of the University of Twente (reference number: 200468). The data was collected from April 11th until April 25th 2020. When signing up for the study via SONA, the respondents were directly redirected to the questionnaire and after finishing the study, they received 0.25 credit points for participation. Participants that were recruited via a personal network were informed on the topic, goal and duration of the study and received an anonymous link to the questionnaire. Before filling in the questionnaire, participants were asked to sign a form of consent, stating that they are allowed to withdraw from the survey at any time and should the results be published in a scientific article they will made anonymous. After signing the informed consent, participants were asked to fill in the online survey. At the end of the questionnaire, participants were thanked for their participation and they were informed that their data was recorded.

3.5 Data analysis

Data was analyzed with SPSS Statistics version 24. Descriptive statistics were calculated for frequencies and percentages or means and standard deviations of the participants demographics, their physical activity and their physical health. Besides, descriptive statistics was used to get

an insight into the binge-watching and TV-watching behavior of the respondents. Pearson's correlation analysis was conducted to investigate a possible relationship between the constructs "amount of online streaming activities per week", "hours spent using online streaming services" and the total scores of physical health and physical activity.

4 Results

In *Table 2* the descriptive statistics of respondents' physical activity, physical health and watching behavior are shown. Concerning physical activity, the mean score was 39.32, which means that on average, participants can be categorized as "active". However, the standard deviation was 21.4, which indicates that there are huge differences in physical activity between the respondents. That can also be seen when looking at the frequencies as the participant scores ranged from 0 to 113. In general, 78.2% of participants fell into the category active, while 12.6% were moderately active and 8.7% were sedentary.

For physical health, the mean score was 6.27, which indicated that on average respondents reported "low" levels of somatic symptom severity. In general, scores on the PHQ-15 can range from 0 to 30. However, in this study, the minimum score was 0 and the maximum was 19. Therefore, a standard deviation of 4.04 means that there were again huge differences between participants. 38.6% of respondents fall into the category of minimal symptoms, while 37.8% had a low level of somatic symptoms and 20.5% had a medium severity of symptoms. Only 3.1% indicated to have high levels of physical complaints.

The variable "Usage streaming services" had a mean of 3.79, which means that on average, participants indicated to make use of online streaming services several times a week. The variable "Hours TV" had the lowest mean (.91), which indicated that 55.6% of participants watches less than one hour TV per day. Moreover, 40.2% of respondents reported to spend two hours per day using online streaming services, which was the highest percentage. The responses for the number of episodes watched in one setting ranged from 1 to 12. Most participants (39.4%), admitted to watch two episodes in one setting.

Table 2. Descriptive statistics of participant´s physical activity, physical health and their watching behavior

Variable	N	Mean	SD	Range	Frequency	Percent
1. Physical activity	122	39.32	21.4	[0-113]		
2. Physical health	127	6.27	4.04	[0-19]		
3. BW hours spend	127	1.84	1.04	Less than one hour	11	8.7
				One hour	36	28.3
				Two hours	51	40.2
				Three hours	22	17.3
				Four hours	5	3.9
				Five hours	2	2.0
4. BW episodes watched	127	2.74	1.65	1	13	10.2
				1.5	3	2.4
				2	50	39.4
				2.5	8	6.3
				3	32	25.2
				3.5	3	2.4
				4	8	6.3
				5	3	2.4
				6	3	2.4
				7	1	.8
				10	2	1.6
				12	1	.8
5. Usage streaming services	127	3.79	1.16	Less than once a week	9	7.1
				Once a week	8	6.3
				2-3 times a week	23	18.1
				Several times a week	47	37.0
				everyday	40	31.5
6. Hours TV	127	0.91	1.33	Less than one hour	71	55.9
				One hour	24	18.9
				Two hours	18	14.2
				Three hours	4	3.1
				Four hours	7	5.5
				Five hours	2	1.8
				Six hours	1	.8

In *Table 3.* the Pearson´s correlations for "BW hours spend", "BW episodes", physical activity and physical health were displayed. Pearson´s r test showed a statistically significant correlation between "BW hours spend" and "BW episodes watched" (r=.492, N=127; p= .00). Therefore, these two variables were used as an indicator of binge-watching. A significant, but weak correlation between physical activity and "BW hours spend" (r=-.179, N=122; p= .048) was found. The relation was slightly negative, which means that if one factor increases the other one decreases. A weak significant correlation was also found between "BW hours spend" and physical health (r=.212, N=117; p= .017). The relation was positive, which means that if one factor increases the other one also increases.

Moreover, the correlation between physical activity and "BW episodes watched" was investigated. The relation was slightly negative (-.147), but not significant as p=.107 The relation between physical health and "BW episodes watched" was weakly positive (.097), but it was also not significant (p=.276).

Table 3. Pearson Correlations for binge-watching, physical health and physical activity

Variables	1	2	3	4
1.Physical activity				
2.Physical health	-.086			
3.BW hours spend	-.179*	.212*		
4.BW episodes watched	-.147	.097	.492**	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

BW: Binge-watching

5 Discussion

5.1 Findings of the study

This study aimed at investigating a possible relationship between binge-watching, physical health and physical activity. It was found that the number of hours using online streaming

services was weakly negatively correlated to the respondent´s total physical activity score. Moreover, the number of hours using online streaming services was slightly positively related to somatic symptom severity. The correlation between physical activity and the number of episodes that are watched in one setting was weakly negative, but not significant. For physical health complaints and number of episodes watched, the correlation was weakly positive, but again not significant.

Reflecting on the study results, the findings were partly in line with already existing literature on binge-watching and physical health. As binge-watching has been linked to physical complaints like reduced sleep quality and sleep disturbances (Flayelle et al., 2020; Sigman, 2007), these findings can be underpinned by this study because physical complaints were found to be related to binge-watching. The findings are also in line with the results of a recent study in which sleep disruptions connected to a lack of sleep were related to binge-watching (Vaterlaus, Spruance, Frantz & Kruger, 2019). However, the relation found between "BW hours spend" and physical health was weak and there was no relationship between "BW episodes watched" and physical health. A possible explanation for that could be that the PHQ-15 questionnaire used in this study, is about many different physical symptoms independently of each other. It may be questionable whether all the somatic symptoms are related to binge-watching. Another explanation could be that in a study by Vaterlaus, Spruance, Frantz & Kruger (2019), negative physical health consequences were mainly related to the intake of unhealthy food and increased or decreased food intake during binge-watching. However, in this study, food consumption was not measured and was thus, not an indicator of physical health. Therefore, including food consumption into the analysis may give a possible explanation for the weak relation between binge-watching and physical health.

The concerns that came up about physical inactivity due to the increased risk of binge-watching (Matrix, 2014) can partly be confirmed by the finding that spending more time using online streaming services was weakly related to reduced physical activity. An explanation for this could be that planned activities may be postponed due to binge-watching behaviour. In previous research it was found that 58% of people are preferring to binge-watch first before doing other activities and 26% of activities postponed are work activities and sport (De Feijter, Kan & Van Gisbergen, 2016). Moreover, binge-watching could even displace other leisure time activities that are more active like doing sports (Dietz, 1990). Additionally, in another study it was found that physical activity was perceived as less important when engaging in binge-watching behaviour (Vaterlaus, Spruance, Frantz & Kruger, 2019), which is also supportive for the

findings in this study. However, as the relation was weak and there was no relation between "BW episodes watched" and physical activity, a possible explanation could be that in a study by Deliens, Deforche, De Bourdeaudhuij & Clarys (2015), it was shown that there are many psychological factors involved like self-discipline, time management and norms and beliefs which were found to influence physical activity as well as sedentary behavior at the same time. Therefore, there may be other factors involved which have an influence on physical activity and binge-watching which were not investigated in the current study. Moreover, in this study, 78.2% of participants can be categorized as being active, which is contradictory to the finding of the WHO that only 46% of adults in Germany have a sufficient physically active level ("Germany Physical Activity Factsheet 2018", 2018). That could be explained by the fact that there are numerous of different public health and clinical recommendations about a sufficient physical activity level, which makes it difficult to compare the findings of this study to other findings (Blair, LaMonte & Nichaman, 2004).

5.2 Strengths and limitations

Strong aspects of this study are that it has focused explicitly on binge-watching behaviour and not like most other studies (e.g. the study by Grøntved, & Hu, 2011, and the study by Hu, Li, Colditz, Willet & Manson, 2003) on sedentary behaviour like TV watching in general. The study has shown that TV watching becomes less important as on average, participants indicated to watch less than one hour per day, which underpins the need to concentrate more on binge-watching, also in the future. As already mentioned in the introduction, little is known about the physical health consequences of binge-watching and in addition, binge-watching can be correlated to risk factors for developing one of the diseases that cause about 60% deaths worldwide (Matrix, 2014; Pittmann & Sheehan, 2015; Waltson-Pattinson, Dombrowski & Presseau, 2016). Therefore, the study can contribute to a better understanding of the relationship between binge-watching, physical health and physical activity.

There were some limitations that will be explained in the following. Firstly, the study was a cross sectional survey, and therefore conclusions about causal inference are difficult to draw. That is because the study was carried out at a certain point of time only for a short period, which means that the study only allows to take a snapshot of the current situation (Levin, 2006). Secondly, the two correlations that were found were very weak and the relations between "BW episodes watched", physical health and physical activity were not significant. As "BW hours spend" and "BW episodes watched" were significantly correlated, it was expected that if one variable correlates to physical health and physical activity, the other would also correlate

significantly. However, the results are not in line with the expectation that both variables can be used as an indicator for binge-watching. Thirdly, it has to be considered that the results may be falsified due to the Corona pandemic. COVID-19 has restricted the possibility for people to leave their homes and engage in their regular activities. Research needs to be conducted after the recovery from COVID-19 in order to determine the lasting impact on physical inactivity and sedentary behaviour (Hall, Laddu, Phillips, Lavie & Arena, 2020). Additionally, the sources of entertainment and social interaction got very limited due to the pandemic, which led to people using more available modes of entertainment in their home settings. Hence, an increase of TV watching and internet usage has been reported, which may also be indicative for increased rates of binge-watching. Therefore, it is not clear whether the results would be the same when doing the study again after the corona pandemic (Dixit, Marthenis, Arafat, Sharma & Kar, 2020). Lastly, the participants were all derived from personal contact or through the platform SONA and therefore, all respondents had similar ages as only students were included. Moreover, 93.7% of the students were German, which does not allow for a great deal of cultural diversity. Thus, results may differ when including also other age groups and people from different cultural backgrounds.

5.4 Recommendations

For future research it is recommended to conduct a study that measures binge-watching behaviour, physical health and physical activity daily over a longer period of time, which could make the results more reliable and more accurate. That is because participants may remember better how many episodes they watched or how many minutes they were physically active, when filling out a questionnaire every day instead of once for the last seven days. Besides, more data would be available as the participants make daily indications on the questionnaire. Furthermore, it would allow to draw causal conclusion, which was not possible in the current study. Moreover, it would be interesting to also include possible weight gain into the study, as binge-watching increased the risk of becoming obese by 23% (Must & Tybor, 2000; Hui, Li, Colditz, Willet & Manson, 2003). Further research could also include eating habits of participants when binge-watching because watching series for a long period is often connected to the intake of unhealthy food, which promotes the risk of weight gain (Thorp, Owen, Neuhaus & Dunstan, 2011; Robinson & Killen, 2001; Coon, Goldberg, Rogers & Tucker, 2001). Besides, as above mentioned, food consumption has not been used as an indicator for physical health. That might be interesting to include, to see whether it can give an indication for a possible explanation of the relationship between physical health and binge-watching. In addition, it may

be advisable to relate somatic symptoms independently of each other to binge-watching, too see which symptoms are most strongly connected to binge-watching and which are less related. Besides, it would be interesting to include psychological factors like self-discipline, time management and norms and beliefs. As already mentioned above, it was shown that there are many psychological factors involved which may influence physical activity, and thus, it may be advisable to analyze, which factors can influence the relation between physical activity and binge-watching. Moreover, it might also be interesting to include not only students but also other age groups and people from a different background. The recommendations could contribute to a clearer picture of the reduced physical health and physical activity of people who engage in binge-watching behavior.

In this study, it was found that 22% of participants were physically inactive. In a study about health risk behaviours in German university students by Keller, Maddock, Hannöver, Thyrian & Basler (2008), it was shown that there are even 59.5% of students who do not engage in sufficient levels of physical activity. The high prevalence of physical inactivity is now considered to be a global public heath priority because of its harmful consequences for people´s health (Kohl et al., 2012). It is important that people become more aware that physical activity and physical health can significantly be reduced when engaging in binge-watching behaviour. Although the relationship that was found in this study was weak, physical inactivity is one of the main mortality risk factors and in Germany there are already 54% of people who fail to reach the recommended physical activity level (Geneva, World Health Organization, 2009; "Germany Physical Activity Factsheet", 2018). Besides, it was found that 84.7% of those who exercised regularly during their college period were still physically active five or ten year later. The same was found among those who did not engage in physical activities. 81.3% of those who preferred a sedentary lifestyle, maintained being physically inactive (Sparling & Snow, 2002).With regard to binge-watching, many viewers show a lack of awareness of their own viewing behaviour and also a lack of control over the viewing time (De Feijter, Khan & Van Gisbergen, 2016), Binge-watching has become a common way for many people to spend their leisure time, despite the negative health consequences (Snyder, 2016), which makes it important to further investigate the relation between binge-watching and physical activity and to find solutions to the health issues that came up.

5.5 Conclusion

All in all, it can be concluded from the study that there is a weak, but significant correlation between binge-watching, physical health and physical activity. However, much more research

is still needed, especially because this study does not allow to draw causal conclusions and because the relations that were found were very weak. In the future, it remains important to see how the phenomenon of binge-watching develops. Moreover, analysis of physical activity remains interesting, as the findings in this study were contradictory to the findings of the WHO and because insufficient physical activity levels can lead to harmful consequences of people´s health.

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Appendix

Binge-watching

Beginn des Blocks: Information letter ?

Q3 **Information letter**

Dear Participant:
We are third-year students in the Department of Psychology at the University of Twente conducting research under the supervision of Nadine Köhle and Erik Taal on the relationship between binge-watching and three different outcome variables namely academic achievement, physical health and extraversion. Online streaming services like Netflix and Amazon Prime Video have gained and are still gaining more users each year all over the world. Watching movies and series online has become a weekly or daily routine for a lot of people. Sometimes, people tend to watch more than two episodes in one setting which is called binge-watching and with our research, we are trying to find out how binge-watching is related to the three variables named above. We would appreciate if you would complete the attached brief survey. Completion of the survey is expected to take about 15 minutes of your time. However, you can withdraw from the survey at any time, without providing a reason. There are no known or anticipated risks to participation in this study. Participation in this project is voluntary and anonymous. Further, all information you provide will be considered confidential.

This study has been reviewed and received ethics clearance through theUniversity of Twente Research Ethics Committee. If you have any complaints about this research, please direct them to the secretary of the Ethics Committee of the Faculty of Behavioural Sciences at the University of Twente (Drs. L.Kamphuis-Blikman P.O. Box 217, 7500 AE Enschede (NL), telephone: +31 (0)53 489 3399; email: l.j.m.blikman@utwente.nl).
For all other questions, please contact:
Esta Terbrack (e.terbrack@student.utwente.nl)
Niklas Hirte (n.j.p.hirte@student.utwente.nl)
Franziska Hanefeld (f.hanefeld@student.utwente.nl)

Yours sincerely,
Esta Terbrack
Franziska Hanefeld
Nicklas Hirte

Ende des Blocks: Information letter ?

Beginn des Blocks: Intro text

Q1 **Informed Consent** I hereby declare that I have been informed in a manner which is clear to me about the nature and method of the study as mentioned before. My questions have been answered to my satisfaction. I agree with my own free will to participate in this research. I reserve the right to withdraw this consent without the need to give any reason and I am aware that I may withdraw from the survey at any time. If my research results are to be used in scientific publications or made public in any other manner, then they will be completely anonymous as no personal identifying information is collected in the survey. My data will not be disclosed to third parties without my express permission. If I request further information about the research, now or in the future, I may contact
Esta Terbrack (e.terbrack@student.utwente.nl)
Franziska Hanefeld (f.hanefeld@student.utwente.nl)
Nicklas Hirte (n.j.p.hirte@student.utwente.nl) If you have any complaints about this research, please direct them to the secretary of the Ethics Committee of the Faculty of Behavioural Sciences at the University of Twente, Drs. L.Kamphuis-Blikman P.O. Box 217, 7500 AE Enschede (NL), telephone: +31 (0)53 489 3399; email: l.j.m.blikman@utwente.nl).

Q18 I read and understood all the above mentioned and agree to participate in the study. Further, I participate out of my own free will and I am informed that I can withdraw from the study at any time without providing a reason.

- ○ Yes (1)
- ○ No (2)

Überspringen bis: Ende der Umfrage Wenn I read and understood all the above mentioned and agree to participate in the study. Further, I p... = No

Ende des Blocks: Intro text

Beginn des Blocks: Demographic information

Q11 Please indicate your gender

- ○ Male (1)
- ○ Female (2)
- ○ Other (3)

Q12 Please indicate your age in years

_____

Q13 Please indicate your current educational level

- Bachelor student (1)
- Master student (2)

Q14 Please indicate your nationality

- Dutch (1)
- German (2)
- Other (3) _____

Ende des Blocks: Demographic information

Beginn des Blocks: Binge-watching

Q26 The following questions are about your usage of streaming services. Please answer them as accurate as possible.

Q7 How often do you use streaming services? (e.g. Netflix, Amazon Prime, etc.)

- ○ Less than once a week. (1)
- ○ Once a week. (2)
- ○ 2-3 times a week (6)
- ○ Several times a week. (3)
- ○ Everyday. (4)

Q8 On average, how many episodes of a series do you watch in one sitting?

_____

Q9 On average, how many hours do you spend using online streaming services per day?

- ○ less than one hour (4)
- ○ one hour (5)
- ○ two hours (6)
- ○ three hours (7)
- ○ four hours (8)
- ○ five hours (9)
- ○ six hours (10)
- ○ seven hours (11)
- ○ more than seven hours (12)

Q10 On average, how many hours do you spend per day watching TV?

- ○ less than one hour (4)
- ○ one hour (5)
- ○ two hours (6)
- ○ three hours (7)
- ○ four hours (8)
- ○ five yours (9)
- ○ six hours (10)
- ○ seven hours (11)
- ○ more than seven hours (12)

Ende des Blocks: Binge-watching

Beginn des Blocks: Self-Control

Q4 Please indicate how much each of the following statements reflects how you typically are.

	Not at all like me (1)	Not like me (4)	Neutral (5)	Like me (6)	Very much like me (7)
I am good at resisting temptations. (1)	○	○	○	○	○
I have a hard time breaking bad habits. (2)	○	○	○	○	○
I am lazy. (3)	○	○	○	○	○
I say inappropriate things. (4)	○	○	○	○	○
I do certain things that are bad for me, if they are fun. (6)	○	○	○	○	○
I refuse things that are bad for me. (7)	○	○	○	○	○
I wish I had more self-discipline. (8)	○	○	○	○	○
People would say that I have iron self-discipline. (9)	○	○	○	○	○
Pleasure and fun sometimes keep me from getting work done. (10)	○	○	○	○	○
I have trouble concentrating. (11)	○	○	○	○	○
I am able to work effectively toward long-term goals. (12)	○	○	○	○	○
Sometimes I can't stop myself from doing something, even if I know it was wrong. (13)	○	○	○	○	○
I often act without thinking through all alternatives. (14)	○	○	○	○	○

Ende des Blocks: Self-Control

Beginn des Blocks: Professional Efficacy

Q19 Please select the option that is most suitable for you.

	Never (1)	Almost never (2)	Rarely (3)	Sometimes (4)	Often (5)	Most of the time (6)	Always (7)
I can effectively solve the problems that arise in my studies. (1)	○	○	○	○	○	○	○
I believe that I make an effecitve contribution to the classes that I attend. (2)	○	○	○	○	○	○	○
In my opinion, I am a good student. (3)	○	○	○	○	○	○	○
I feel stimulated when I achieve my study goals. (4)	○	○	○	○	○	○	○
I have learned many interesting things during the course of my studies. (5)	○	○	○	○	○	○	○
During class, I feel confident that I am effective in getting things done. (6)	○	○	○	○	○	○	○

Ende des Blocks: Professional Efficacy

Beginn des Blocks: Big Five (BFI)

Q5

Here are a number of characteristics that may or may not apply to you. Please indicate for each statement, the extent to which you agree or disagree with that statement. I see myself as someone who...

	strongly disagree (1)	disagree (2)	neutral (3)	agree (4)	strongly agree (5)
Is talkative. (1)	○	○	○	○	○
Is reserved. (3)	○	○	○	○	○
Is full of energy. (4)	○	○	○	○	○
Generates a lot of enthusiasm. (5)	○	○	○	○	○
Tends to be quiet. (6)	○	○	○	○	○
Has an assertive personality. (7)	○	○	○	○	○
Is sometimes shy or inhibited. (8)	○	○	○	○	○
Is outgoing, sociable. (9)	○	○	○	○	○

Ende des Blocks: Big Five (BFI)

Beginn des Blocks: Physical Health

Q20 During the past seven days how much have you been bothered by the following?

	Not bothered at all (1)	Bothered a little (2)	Bothered a lot (3)
Stomach pain (1)	○	○	○
Back pain (2)	○	○	○
Pain in your arms, legs, or joints (knees, hips, etc.) (3)	○	○	○
Menstrual cramps or other problems with your periods WOMEN ONLY (4)	○	○	○
Headaches (5)	○	○	○
Chest pain (6)	○	○	○
Dizziness (7)	○	○	○
Fainting spells (8)	○	○	○
Feeling your heart pound or race (10)	○	○	○
Shortness of breath (11)	○	○	○
Pain or problems during sexual intercourse (12)	○	○	○
Constipation, loose bowels, or diarrhea (13)	○	○	○
Nausea, gas, or indigestion (14)	○	○	○
Feeling tired or having low energy (15)	○	○	○
Trouble sleeping (16)	○	○	○

Ende des Blocks: Physical Health

Beginn des Blocks: Block 10

Q30 During a typical 7-Day period (a week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time? (write in each text field the appropriate number)

	Times per week (1)
STRENUOUS EXERCISE (HEART BEATS RAPIDLY) (e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling) (1)	
MODERATE EXERCISE (NOT EXHAUSTING) (e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing) (2)	
MILD/LIGHT EXERCISE (MINIMAL EFFORT) (e.g., yoga, archery, fishing from river bank, bowling, horseshoes, golf, snow-mobiling, easy walking) (3)	

Ende des Blocks: Block 10

Beginn des Blocks: Debriefing

Q15 Thank you for participating in this study! **To safe your answers, please click on the right.**

Ende des Blocks: Debriefing