

A Period of Abstinence from Masturbation and Pornography Leads to Lower Fatigue and Various Other Benefits: A Quantitative Study

Jochen Straub^{1*} and Casper Schmidt²

¹Innsbruck University, Austria

²Department of Communication and Psychology, Aalborg University, Denmark

*Correspondence to:

Jochen Straub
Innsbruck University, Austria
Tel: +49 1515 6684743
E-mail: straub.jochen1992@gmail.com

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Abstract

Many young men have noticed significant personal benefits from abstaining from online pornography and masturbation which has resulted in a large online movement. This study is a step toward quantitatively exploring these benefits in 21 single men who underwent three weeks of pornography and masturbation abstinence. When comparing the abstinence group to a control group, we found significantly strong effects of reduced mental and physiological fatigue. Furthermore, medium effects were discovered in measures of increased wakefulness, activity, inspiration, self-control, and reduced shyness. Participants who additionally abstained from sex showed even stronger effects in reduced mental and physiological fatigue. The effects found suggest energizing and performance-enhancing potentials in a non-clinical group of single male subjects. These findings could be relevant to the treatment of a range of clinical symptoms including social anxiety, lethargy, and fatigue. A limited period of sexual abstinence might also increase personal, athletic, and professional performance.

Keywords

Pornography, Masturbation, Sexual abstinence, Benefits, Well being

Introduction

In the last decade, a large online movement has emerged dealing with abstinence from pornography and masturbation (=OM; e.g., <https://nofap.com/>; <http://www.reddit.com/r/NoFap/>; <http://www.rebootnation.org>). The movement is growing steadily (e.g., <http://www.reddit.com/r/NoFap/> with 116,000 members in 2014 [1] grew to 906,800 members by December 10th, 2021) and receiving increasing attention in mainstream media [2].

Within the OM, there are many anecdotal reports of significant benefits through abstinence from pornography and masturbation (=APM). They encompass mental health benefits, such as reduced depressiveness and shyness. According to the anecdotal reports, APM also has enlivening effects via reduced fatigue, clearer thinking and increased motivation for different activities. Although a qualitative study [3] has affirmed these benefits no other study has attempted to verify these reports quantitatively. This study is a first step in quantitatively investigating the numerous anecdotal benefits from APM.

To date, there appears to be only one study [3] that has examined the benefits of abstaining from pornography on psychological affect related to the previously described OM. Their qualitative analysis of OM diaries found that mood,

motivation, mental clarity, self-confidence, and productivity had improved through APM. Another team of researchers, Negash et al. [4], observed that abstinence from pornography led to greater valuation of larger postponed rewards compared with smaller immediate rewards. In comparison, a control group that abstained from favorite foods did not show these effects. Pornography abstinence also led to increased commitment in romantic partnerships [5]. An endocrine study found that three weeks of ejaculatory abstinence could increase testosterone release during masturbation [6].

In clinical studies, positive effects of therapeutic fasting have been observed that are similar to the benefits of “pornography and masturbation fasting” in the OM. For example, dietary fasting was accompanied improved daytime concentration, sleep quality and emotional balance [7]. Another study [8] found that dietary short-term fasting improves mood, pride and a sense of achievement. We found a study that investigated the positive effects of Ramadan fasting [9] which had strong similarities with our study in terms of sample size (N = 25), variables studied, and study period (in summer). Within the Ramadan group, researchers found positive effects in terms of reduced fatigue and sleepiness and better mood. However, the improvements of the Ramadan group were not so pronounced as to be statistically significant compared to the control group.

Neurological background

We hypothesize that neurological factors may play an important role in explaining beneficial effects of APM. Internet pornography contains additional arousal-promoting elements that can cause an even higher levels of arousal than partnered sex. Dopamine is strongly involved in sexual arousal and desire and is elevated significantly during sexual activities [10]. Internet pornography has been proposed as a “supernormal stimulus,” that is, an artificially enhanced and more stimulating version of a natural reward [11]. Internet pornography offers a nearly unlimited number of novel pornographic videos. Previous studies observed that novel explicit material increases and retains sexual arousal [12] and can activate the dopaminergic reward system additionally [13]. Novelty further increases arousal if it is combined with the anticipation of a reward [14]. Surveys on the characteristics of consumption of sexually explicit material [15] have revealed that some viewers gradually tend to watch pornographic content that is no longer in alignment with their sexual preferences or orientation. A possible explanation is that scenes of a more extreme or novel nature may create a “shock effect” that further increases arousal.

Only relatively few studies have investigated sexual behavior in connection with neural correlates. Kühn and Gallinat [16] discovered that higher pornography consumption was associated with greater structural impairment in dorso-lateral striatal structures (right caudate and left putamen) in a nonclinical sample. They found lower functional connectivity between the right caudate and the left dorsolateral prefrontal cortex. This circuit is heavily involved in exerting cognitive control [17].

Striatal impairment has been associated with functional depreciation. Lorist et al. [18] found that patients with stri-

atal dopamine deficiencies experienced more mental fatigue. Other preclinical studies have shown that striatal impairment (in primates) led to dysfunctional sleep-wake regulation by reduced daytime arousal and increases the need for daytime naps. Mesostriatal impairment has similarly been associated with dysfunctional regulation of mood and anxiety [19].

Schmidt et al. [20] published the first study assessing the structural neural correlates of compulsive sexual behavior (= CSB) with voxel-based morphometry. They examined structural neural differences between healthy and CSB subjects, where CSB subjects exhibited increased left amygdala volume which is involved in motivational salience. Further, CSB subjects displayed reduced functional connectivity between the amygdala and the dorsolateral prefrontal cortex compared with the control group. A reduction in this connection has been associated with impaired emotion regulation [21]. Furthermore, malfunctional emotion regulation has been associated with depressed mood and shyness [22].

Studies within meth-amphetamine use [23] have found evidence that abstinence can help neurological reward structures recover. The rate of recovery was negatively correlated with the dose and years of use humans [23]. Neurological research has identified similar mechanisms between sexual and substance-induced rewards review [24]. Therefore, it is likely that these processes are also relevant for sexual abstinence.

Psychological background

Higher pornography use could be associated with lower mental health (e.g., Depression [16]; Shyness [5]. A qualitative analysis of 53 self-perceived problematic pornography users [26] found four key effects of use on mental health and well-being. Participants reported psychological problems such as social and general anxiety and depressive symptoms that included isolation behaviors, anhedonia, and depressed mood. Another main theme was the inability to focus on complicated or lengthy tasks. The third sub-theme was decreased energy and motivation, often caused by lack of sleep due to pornography use. Finally, participants reported that their use negatively affected their self-esteem and was often accompanied by feelings of guilt and shame. A study [27] researched the relationship between pornography use, moral disapproval of it, and sexual shame. They observed that both sexual shame and moral disapproval were associated with an increase in the experience of depression. Another study [28] found that individuals who frequently used pornography and perceived it as problematic had significantly greater problems (e.g., depression, lower self-esteem) than individuals who did not perceive their frequent use as problematic. The experience of moral incongruency is not exclusive for self-perceived addiction to pornography use but can be found in other behavioral addictions as well [29].

The effort of sustaining abstinence is sometimes accompanied with certain psychological changes. This may help explain some of the benefits we saw reported in OM. Successfully abstaining from pornography and masturbation sometimes led to a sense of regained control over consumption and also in other areas of life [3]. As basic research [30] has shown that self-control is strengthened through exerting self-control,

the effort to resist sexual cravings could perhaps strengthen self-control in other domains of life.

The present study

The numerous anecdotal self-reports from the OM cite various benefits, sometimes described as "life-changing" or with similar descriptions of marked improvements. Commonly named benefits were, amongst others, reduced depressiveness, shyness, mental and physiological fatigue and increased positive feelings, motivation and self-control. As mentioned earlier, Fernandez et al. [3] independently found similar improvements. As such, these specific benefits served as our research variables. The potential improvements could have a positive impact on various aspects of life. To date, however, there are no experimental studies that capture this phenomenon. This study aims to fill this gap and determine, whether three weeks of APM can produce improvements in the previously mentioned research variables.

Methods

Procedure and participants

We had an experimental group (=EG) and a control group (=CG). A previous study [31] found evidence that motivation for an APM is almost exclusively (99%) present in men. For this reason, and to exclude gender effects, we restricted our study to male participants. Sexual intercourse was not restricted by the study design, but participants of both groups should not be engaged in an established sexual relationship. Both groups were recruited during summer in 2020. Our study was designed without the incorporation of specific diagnoses for problematic pornography use, compulsive sexual behavior or other clinical categories.

Both groups underwent the following procedure. All participants completed a baseline questionnaire (=T1), the content of which is described below. The follow-up questionnaire (=T2) was sent after a period of three weeks using a mail schedule function.

Participants of the EG were recruited through personal contact, social media or via the email distribution list of an Austrian university. The various recruitment strategies were used to aim for the largest possible sample size. The recruitment process of the CG was done entirely via the email distribution list of the same university. All participants recruited through the email distribution list received subject hours required for a bachelor's degree in psychology. The CG was recruited with blinded intentions. The study was billed as an investigation of changes in various personality constructs over time. We used the control group to exclude confounding seasonal, situational, and other possible effects as much as possible.

Recruitment of the EG was performed in an unblinded fashion. The EG was instructed to attempt to remain abstinent from pornography and masturbation for at least three weeks after completing T1. T2 was filled out after completion of three weeks of APM.

Sixty-two participants of the EG finished T1. Forty-four

of these participants also filled out T2. The following describes the selection process for our statistical analysis. These 44 participants were filtered by the question, "How often did you masturbate during the study period?" Only participants who were able to completely abstain from masturbation were eligible for further analysis. Two participants were additionally excluded from the study as they reported masturbating less than once per week and watching pornography for less than half an hour per week. Thus, their consumption was considered as too infrequent. The remaining 21 participants are referred to as the APM subgroup in this study.

Another question from T2 asked EG participants if they had sexual intercourse during the study period and how often ("How often did you have sex during the study period?"). This was used to create an APM subgroup with a complete sexual behavioral abstinence. Only participants who had not masturbated and additionally did not have partnered sex during the study period were assigned to the abstinence from sex, masturbation, and pornography (=APMS) subgroup. The APMS-subgroup consisted of 11 remaining participants.

Twenty-five participants of the control group (CG) completed both questionnaires. One CG participant apparently did not answer the questionnaire truthfully and was removed. Twenty-four CG-participants were used for comparison with the EG.

Questionnaires

All questionnaires were sent out using the web-based survey tool "Sosci Survey". All measurements were collected based on self-reported data. The EG and CG each received the same battery of questionnaires at T1 and T2. These questionnaires were used to compare longitudinal changes in the values of our research variables between T1 and T2. The questionnaires we analyzed showed Cronbach's alpha coefficients ranging from .83 to .89. These values represent sufficient reliability [32].

Our battery of questionnaires included the following scales. Self-control was measured with the "Brief Self-Control Scale" (BSCS [33]). It assesses general self-control and the ability to act effectively and in a goal-directed manner. The scale consists of 13 items.

We extracted the "Shyness-scale" from the "Shyness and Sociability Scales for Adults" (SGSE [34]). The "Shyness Scale" asked six questions about unpleasant feelings and inhibitions in the presence of other people as well as social avoidance behavior.

The eleven-item "Fatigue Scale" (FS [35]) consists of two factors that are physiological fatigue (e.g., tiredness, feeling weak etc.) and mental fatigue (problems concentrating and thinking clearly).

The Short Depression-Happiness Scale (SDHS [36]) consisting of six items assesses a bipolar continuum with depressiveness at one end and happiness at the other. In our study, scores on this scale were listed under "depressiveness," with higher scores indicating higher depressiveness or lower happiness conversely.

We used the 10 positive feelings of the “Positive and Negative Affect Schedule (PANAS; [37]. The questionnaire measures the frequency of a wide range of positive feelings such as being “strong”, “proud”, “active” or “interested. This scale is referred to as “positive feelings” in our study.

We used the Motivation and Pleasure Scale-Self Report (MAP_SR [38] in part. We employed three questions concerning motivation (“In the past week how motivated have you been to do hobbies or other recreational activities”) and three asking for the actual effort expended (“In the past week how much effort have you made to actually do any hobbies or recreational activities?”). We asked about motivation and actual effort for each of the categories of social, recreational, and work/educational activities.

The questionnaires (SDHS, physiological fatigue, mental fatigue, PANAS, MAP_SR) referred to the past week, except that the shyness and self-control scales assessed how the participants typically feel about themselves.

The EG was additionally asked questions about their sexual behavior. T1 asked about average weekly pornography use and average masturbation frequency (each in the past three months). We also asked about the degree of shame associated with their masturbation practices. The T2 questionnaire also included the filtering questions described earlier.

Statistical analysis

All analyses were conducted with IBM SPSS Statistics 26.

We used a two-way repeated measures analysis of variance (ANOVA) to determine differences between the EG and CG at the end of the three-week study period. The potential improvements had to be pronounced enough for us to detect a statistically significant interaction effect. This suggested that the differences between the CG and EG were due to the experimental condition of APM. T-test for dependent samples were utilized for additional confirmation of the interaction. We used Cohen’s d [39] to determine the effect size of the results. We used Z-values [40] to detect violations of the normal distribution.

Results

Descriptive measures

Descriptive measures of EG sexual behavior and attitudes prior to abstinence are presented in table 1.

Two-way repeated measures ANOVA

Z-values outside the range of -1,96 to 1,96 indicated a violation of normal distribution. In our study, all research-variables of the EG did not show any violation of the normal distribution. The CG showed divergence from the standard deviation in positive feelings at T1 (skew = 2, 23; kurtosis = 3, 26) and T2 (skew = 2, 66; kurtosis = 3, 5). Shyness in the CG also violated the normal distribution (T1: skew = 4, 9; kurtosis = 8, 1; T2: skew = 5, 4). For Cohen’s d values, a small effect starts at 0, 2 and medium effects range from 0, 5 to 0, 8. D values above 0, 8 are considered as strong effects. The results of the ANOVA for the APM-subgroup and APMS-subgroup are summarized in table 2.

Both abstinence subgroups showed significantly reduced mental and physiological fatigue compared to CG. But the APMS subgroup (physiological fatigue: d=1,03; p=.003; mental fatigue: d = 1,2; p = .001) showed even stronger reductions in reduced mental and physiological fatigue than the APM subgroup (physiological fatigue: d = 0,8; p = .001; mental fatigue: d = 0,82; p = .001). These were the only salient differences between the APM and APMS subgroup. Therefore, the remaining research variables are presented as a single unit for overview purposes.

Interactions of medium effect size were found in for increased self-control (d = 0,7; p = .004) and reduced shyness (d = 0,47; p = .039). The two positive feelings “awake” (d = 0,6; p = .011) and “inspired” (d = 0,48; p= .034) also showed a medium interaction. All previous listed interactions effects could be confirmed with a post hoc analysis.

The positive feeling “active” (d = 0,45; p = .047) and positive feelings (d = 0,44; P = .036) indicated a significant interaction in the post-hoc but not in ANOVA analysis. Depressiveness decreased significantly in both CG and EG, with no statistically significant interaction. Similarly, both CG and

Table 1: Masturbation frequency and weekly pornography consumption and perceived shame at T1.

Masturbation Frequency	N	Pornography consumption	N	Perceived Shame	N
less than once a week	0	less than half hour/week	3	not at all	9
once a week	2	half to an hour/week	5	a little	7
two to three times/week	8	one to three hour/week	6	moderate	1
four to six times/week	7	three to five hour/week	5	quite a bit	1
every day	1	five to seven hour/week	1	very much	3
two to three times/day	3	more than seven hour/week	1		

Table 2: Mean differences between T1 and T2; Main and Interaction effects from two way repeated measures ANOVA.

Research variables	APM-subgroup		APMS-subgroup		Control Group		Main Effect (F)		Interaction (F)		
		T1	T2	T1	T2	T1	T2	APM	APMS	APM	APMS
depressiveness	M	2,6	2,3	2,45	2,23	2,25	2,07	10,47	4,50	0,9	0,28
	S	0.8577	0.771	0.716	0.677	0.612	0.562	p = .002	p = .042	p = .349	p = -.869
Shyness	M	2,75	2,52	2,56	2,37	2,97	2,99	3,67	1,92	5,51	3,32
	S	0.684	0.726	0.448	0.468	0.512	0.491	p = .062	p = .175	p = .023	p = .080
Phys. Fatigue	M	2,84	2,14	2,89	2,09	2,48	2,46	11,91	16,5	10,87	15,22
	S	0.851	0.654	0.695	0.637	0.637	0.664	p = .001	p = <.001	p = .002	p = <.001
Mental Fatigue	M	3	2,71	2,9	2,06	2,73	2,54	17,2	28,2	4,9	11,27
	S	0.912	0.822	0.91	0.86	0.661	0.752	p = <.00	p = <.001	p = .032	p = .002
Self-control	M	2,86	3,25	2,84	3,3	3,08	3,15	11,71	11,46	6,1	6,66
	S	0.727	0.564	0.569	0.513	0.555	0.578	p = .001	p = .002	p = .018	p = .015
Motivation (Recreational)	M	3,5	3,91	3,62	4,32	3,81	4,1	4,87	6,55	0,15	0,89
	S	1,14	1,02	0,961	0,832	1,08	1,08	p = .033	p = .015	p = .697	p = .352
Motivation (Social)	M	3,59	3,95	3,69	4,15	3,81	4,1	5,57	6,10	0,8	0,34
	S	1,01	0,84	1,032	0,899	1,03	1,09	p = .021	p = .019	p = .779	p = .565
Positive Feelings	M	3,24	3,62	3,28	3,7	3,3	3,4	5,78	8,89	1,97	3,33
	S	0.731	0.556	0.627	0.561	0.769	0.786	p = .021	p = .005	p = .167	p = .077
awake	M	3	3,55	3	3,62	3,52	3,43	3,28	3,3	6,63	6,21
	S	0.873	0.912	0.707	1,04	0.812	0.978	p = -.078	p = .077	p = .014	p = .018
inspired	M	2,91	3,54	2,92	3,54	3,29	3,19	2,51	4,81	4,81	6,21
	S	0.971	0.776	0.76	0.776	0.845	0.981	p = .0121	p = .034	p = .032	p = .018

EG showed increased motivation for social and recreational activities at the end of the study, but no interaction effects.

Discussion

Summary and practical implications

The aim of our study was to investigate whether the anecdotal benefits reported on OM could be found in an experimental study. We found evidence that APM reduces mental and physiological fatigue and shyness and increases self-control, activity, wakefulness, and inspiration. Intriguingly, our re-

sults are highly congruent with the findings of a recently published qualitative study [3] of the OM. They found improved mood, motivation, mental clarity, confidence, and productivity. Although we did not find statistically significant improvements in mood and motivation, we did observe other results that point in a similar direction as Fernandez et al. [3] findings. Increased mental clarity may equate to reduced mental fatigue in our results. While shyness and self-confidence are not completely identical, being less anxious and inhibited in social contexts can probably be considered part of self-confidence. Finally, reduced mental and physiological fatigue is also

likely to contribute to the increase in productivity found by Fernandez et al. [3].

Our findings suggest that it is possible to realize potential beneficial effects in one's personal and social life by abstaining from pornography and masturbation. The combination of enlivening effects and strengthened self-control could raise productivity in nearly every endeavor, whether personal, athletic, or professional. Also, sexual abstinence has been used to boost peak performance, for example by elite athletes [41].

The strongest effects were reduced mental and physiological fatigue. Fatigue leads to decreased productivity and has previously been estimated to cost employers in the US an estimated hundred billion dollars annually [42]. Further, fatigue has negative consequences for one's social and personal life [42]. Experimental APM as an occupational training exercise could potentially provide benefits for both employees and employers.

We also noticed a reduction in shyness, which could lead to improvements in social life. It is conceivable that this effect could serve as a supportive tool in the treatment of social anxiety. The energizing effects of APM or APMS could help patients overcome lethargy, and APM could potentially be used as a tool to combat fatigue. Further studies could examine whether there may be potential applications in different clinical and non-clinical populations table 3.

Explanatory approach

First of all, some elements of our explanatory approach should be taken with caution, as neurological research on pornography users is still in its infancy. Neurological and mental health studies [16, 20] using a purely correlational approach cannot establish a causal relationship between pornography and neurological impairment. For example, identified structural impairment could also be due to a pre-existing condition such as "Reward Deficiency Syndrome" (=RDS). RDS is a brain disorder characterized by a clinically significant deficiency of the essential dopamine neurotransmitter which leads to higher demand for stimulation [43]. Although previous studies have demonstrated neurological recovery processes [23], the relationship between neurological recovery and found psychological improvements remains unclear. Further studies could examine this connection and deliver important insights in the recovery of reward (ab) use in general.

We hypothesize that the beneficial effects result from a combination of neurological and psychological changes that accompany APM.

The regeneration processes of reward structures, described in the introduction, may have contributed to the observed improvements in the experience of shyness, self-control, and mental and physiological fatigue. The only noticeable difference between the two subgroups, APM and APMS, was an even greater reduction of mental and physiological fatigue in the APMS subgroup. Here, it is speculative whether the APMS subgroup have experienced greater regeneration of reward structures by completely abstaining from sexual stimulation.

Table 3: Post HOC result (T-Test with dependent measures) in d values transformed in Cohen's D values.

Depressiveness	d	0, 5	0, 44
	p	0.029	0.035
Shyness	d	0, 47	ns.
	p	0.039	
Positive Feeling	d	0, 44	ns.
	p	0.036	
Feeling awake	d	0, 6	ns.
	p	0.011	
Feeling inspired	d	0, 48	ns.
	p	0.034	
Feeling active	d	0, 45	ns.
	p	0.047	
Phys Fatigue	d	1, 03	ns.
	p	0.003	
Mental Fatigue	d	0, 82	ns.
	p	0.001	
Self-Control	d	0, 7	ns.
	p	0.004	
Motivation (Recreational)	d	ns.	ns.
	p		
Motivation (Social)	d	ns.	ns.
	p		

Note: d= Cohen's d; small effect = .20-.50; medium effect = .50-.80 strong effect = >.80; ns. =not significant

The effort to pursue APM and the successful completion of it may have facilitated some of the improvements reported. Regaining control through APM may have increased perceived self-efficacy and personal autonomy. A lack of self-efficacy has been shown to be associated with shyness [44]. Therefore, our results reporting reduced shyness may have been influenced by an increased sense of self-efficacy. As already mentioned, self-control is developed by exercising it and as such, this could explain these improvements.

In summary, we hypothesize that the reduction in shyness and improvement in self-control are potentially due to both neurological and psychological factors. The energizing effects may have been generated mainly by improved functionality of reward structures through reduced stimulation.

Anecdotal reports encompass improvements on well-being. Although both positive feelings and reduced depressiveness showed a positive development, we did not find statistically significant differences compared with the CG. A shameful attitude towards one's masturbation practice can have a negative impact on mental health [28, 29]. However, most of our participants reported little to no shame. It is possible that improvement in mood and happiness is more pronounced in individuals who have a shameful attitude toward their pornography and masturbation use and have come to terms with themselves again through APM. In addition, sit-

uational factors, which will be presented later, may have also distorted the findings on well-being.

Sexual versus dietary fasting

Food rewards [45] have also been found to stimulate reward circuits. Sexual and dietary fasting both seem to have a vitalizing effect on the body and [7-9]. The energizing effects of both variants could be caused by the reduced stimulation of the reward circuits. As already stated in the introduction, one study [9] on fasting during Ramadan is conceptually quite identical to ours. Although both fasting variations resulted in less fatigue, APM suggests more pronounced improvements than those seen in Nugraha [9]. A possible explanation would be that the differences are due to the different intensities of stimulation of food and sex, respectively, which has been supported previously [4]. Pornography abstinence led to a shift in preference from short-term rewards of lower value to deferred rewards of greater value. This change was not observed in the control group, which abstained from their favorite food.

Confounding influences

Reduced depressiveness and increased motivation for social and recreational activities were found in both groups (EG, CG). This study took place in 2020 during the COVID-19 pandemic which caused many restrictions to public life (the closing of sport clubs, restaurants, cultural events, and restrictive social guidelines for avoiding personal contact). These restrictions loosened up or abated during the study period and partly restored public life. This may have affected participants' observations in both groups. In our results we reported only significant differences between the two groups.

Other rewards (substance and behavioral rewards) influence the reward system as well (e.g., excessive internet consumption [46] social media [47] substances [23]). Participation in APM may have led to different patterns of consumption. For example, some participants may have also reduced consumption of other rewards, while other participants may have attempted to compensate for the lack of sexual stimulation with other rewards. Future studies could attempt to experimentally control for these potentially confounding effects, which could impact neurological regeneration processes.

Finally, participants may have had expectation biases about the effects of the APM beforehand. Expectation effects could have influenced the participants and thus the results. Future studies could control for these potentially confounding effects. As previously mentioned, the observed effects may have been related partly to the beneficial effects of exerting self-control.

Conclusion and Future Studies

Existing literature already implies a direct relationship between impairment from pornography use and recovery from it through abstinence. For example, [29] found that self-identified problematic pornography users attributed some characteristic limitation (e.g., physical and mental fatigue, decreased confidence, motivation and lowered mood) as an effect of their use. Conversely, a qualitative analysis of APM dia-

ries [3] found that key improvements affected the same areas perceived to be affected by problematic pornography use. Our study could confirm many of the qualitative findings from Fernandez and colleagues [3] with an experimental and quantitative approach. In summary, our findings are highly congruent with both recent qualitative evidence as well as numerous reports from large OMs.

This study underscores that an APM offers several advantages and can be used to realize more fully one's inherent potential. The potential benefits this study also increases scientific evidence that the benefits of the OM have a real background.

What this study cannot answer is the degree to which the observed improvements are due to the omission of pornography and masturbation and thus recovery from its (potentially) impairing influence, and thus cannot make causal inferences about the effects of APM. We thus warrant future researchers to examine this in more detail through isolating these effects in an experimental design.

Reports from OM suggest that there are other potential benefits beyond those examined in this study, such as improved sexual performance, increased relationship commitment, and increased creativity and engagement in new hobbies and other activities. Three weeks may be too short a period to reveal the full benefits of APM. Earlier studies suggest that an overstimulated reward system still shows recovery-progress after multiple months of abstinence [26]. Future studies could thus research longer periods of APM.

As this study focused solely on a male sample, it would be of interest whether women can benefit from APM as well. As mentioned, more studies examining APM in the context of a specific outcome and setting (e.g., clinical, or occupational) may also yield interesting results. Endocrinological and neurological measurements could provide further *in vivo* information on the exact processes involved in APM at different physiological levels of description. Knowledge about the impact of diverse rewards on aspects of daily life would be enriched by studies about other forms of reward abstinence. There are other abstinence movements or variations that anecdotally also provide significant benefits. Some examples would be complete abstinence from drugs (informally known as "straight edge"), some variations of Internet abstinence (e.g., abstaining from social media or entertainment media), or from (almost) all sources of instant gratification combined (also referred to as "dopamine fasting"). It is quite possible that other or similar benefits could be found in conjunction with these different reward abstinence variations.

Declarations

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Conflicts of Interest

The authors declare they have no conflicts of interest.

References

1. Wilson G. 2014. Your brain on porn: Internet pornography and the emerging science of addiction. Commonwealth Publishing Richmond, VA, USA.
2. Rise of No Fap: Why Young Men Are Quitting Masturbation. https://www.huffingtonpost.co.uk/entry/why-are-young-men-stopping-themselves-masturbating_uk_5d2f0f49e4b0a873f6449ff8] Accessed on May 11, 2022
3. Fernandez DP, Kuss DJ, Griffiths MD. 2021. The pornography “rebooting” experience: a qualitative analysis of abstinence journals on an online pornography abstinence forum. *Arch Sex Behav* 50(2):711-728. <https://doi.org/10.1007/s10508-020-01858-w>
4. Negash S, Sheppard NVN, Lambert NM, Fincham FD. 2016. Trading later rewards for current pleasure: pornography consumption and delay discounting. *J Sex Res* 53(6): 689-700.
5. Lambert NM, Negash S, Stillman TF, Olmstead SB, Fincham FD. 2012. A love that doesn't last: Pornography consumption and weakened commitment to one's romantic partner. *Journal of Social and Clinical Psychology* 31(4): 410-438. <https://doi.org/10.1521/jscp.2012.31.4.410>
6. Exton MS, KruEger THC, Bursch N, Haake P, Knapp W, et al. 2001. Endocrine response to masturbation-induced orgasm in healthy men following a 3-week sexual abstinence. *World J of Urol* 19(5): 377-382. <https://doi.org/10.1007/s003450100222>
7. Michalsen A, Schneider S, Rodenbeck A, Lütcke R, Huether G, et al. 2003. The short-term effects of fasting on the neuroendocrine system in patients with chronic pain syndromes. *Nutr Neurosci* 6(1): 11-18. <https://doi.org/10.1080/1028415021000042811>
8. Watkins E, Serpell L. 2016. The psychological effects of short-term fasting in healthy women. *Front Nutr* 3: 27. <https://doi.org/10.3389/fnut.2016.00027>
9. Nugraha B, Ghashang SK, Hamdan I, Gutenbrunner C. 2017. Effect of ramadan fasting on fatigue, mood, sleepiness, and health-related quality of life of healthy young men in summer time in Germany: a prospective controlled study. *Appetite* 111: 38-45. <https://doi.org/10.1016/j.appet.2016.12.030>
10. Krüger THC, Kneer J. 2017. Neurobiologische Grundlagen der Sexualität und ihrer Probleme. *Nervenarzt* 88(5): 451-458. <https://doi.org/10.1007/s00115-017-0300-8>
11. Park BY, Wilson G, Berger J, Christman M, Reina B, et al. 2016. Is internet pornography causing sexual dysfunctions? a review with clinical reports. *Behavioral Sciences* 6(3): 17. <https://doi.org/10.3390/bs6030017>
12. Koukounas E, Over R. 2000. Changes in the magnitude of the eyeblink startle response during habituation of sexual arousal. *Behav Res Ther* 38(6): 573-584. [https://doi.org/10.1016/s0005-7967\(99\)00075-3](https://doi.org/10.1016/s0005-7967(99)00075-3)
13. Parkitna JR, Sikora M, Gołda S, Golembiowska K, Bystrowska B, et al. 2013. Novelty-seeking behaviors and the escalation of alcohol drinking after abstinence in mice are controlled by metabotropic glutamate receptor 5 on neurons expressing dopamine d1 receptors. *Biol Psychiatry* 73(3): 263-270. <https://doi.org/10.1016/j.biopsych.2012.07.019>
14. Krebs RM, Heipertz D, Schuetze H, Duzel E. 2011. Novelty increases the mesolimbic functional connectivity of the substantia nigra/ventral tegmental area (SN/VTA) during reward anticipation: evidence from high-resolution fMRI. *Neuroimage* 58(2): 647-655. <https://doi.org/10.1016/j.neuroimage.2011.06.038>
15. Downing MJ, Schrimshaw EW, Scheinmann R, Antebi-Gruszka N, Hirshfield S. 2017. Sexually explicit media use by sexual identity: A comparative analysis of gay, bisexual, and heterosexual men in the United States. *Arch Sex Behav* 46(6): 1763-1776. <https://doi.org/10.1007/s10508-016-0837-9>
16. Kühn S, Gallinat J. 2014. Brain structure and functional connectivity associated with pornography consumption: the brain on porn. *JAMA Psychiatry* 71(7): 827-834. <https://doi.org/10.1001/jamapsychiatry.2014.93>
17. Miller EK, Cohen JD. 2001. An integrative theory of prefrontal cortex function. *Annu Rev Neurosci* 24(1): 167-202. <https://doi.org/10.1146/annurev.neuro.24.1.167>
18. Lorist MM, Boksem MAS, Ridderinkhof KR. 2005. Impaired cognitive control and reduced cingulate activity during mental fatigue. *Brain Res Cogn Brain Res* 24(2): 199-205. <https://doi.org/10.1016/j.cogbrainres.2005.01.018>
19. Zarrindast MR, Khakpai F. 2015. The modulatory role of dopamine in anxiety-like behavior. *Arch Iran Med* 18(9): 591-603.
20. Schmidt C, Morris LS, Kvamme TL, Hall P, Birchard T, et al. 2017. Compulsive sexual behavior: prefrontal and limbic volume and interactions. *Hum Brain Mapp* 38(3): 1182-1190. <https://doi.org/10.1002/hbm.23447>
21. Banks SJ, Eddy KT, Angstadt M, Nathan PJ, Phan KL. 2007. Amygdala-frontal connectivity during emotion regulation. *Soc Cogn Affect Neurosci* 2(4): 303-312. <https://doi.org/10.1093/scan/nsm029>
22. Eisenberg N, Fabes RA, Murphy BC. 1995. Relations of shyness and low sociability to regulation and emotionality. *J Pers Soc Psychol* 68(3): 505-517. <https://doi.org/10.1037/0022-3514.68.3.505>
23. Volkow ND, Chang L, Wang GJ, Fowler JS, Franceschi D, et al. 2001. Loss of dopamine transporters in methamphetamine abusers recovers with protracted abstinence. *J Neurosci* 21(23): 9414-9418. <https://doi.org/10.1523/JNEUROSCI.21-23-09414.2001>
24. de Alarcon R, de la Iglesia J, Casado NM, Montejo AL. 2019. Online porn addiction: what we know and what we don't - a systematic review. *J Chin Med* 8(1): 91. <https://doi.org/10.3390/jcm8010091>
25. Luster SS, Nelson LJ, Poulsen FO, Willoughby BJ. 2013. Emerging adult sexual attitudes and behaviors: Does shyness matter? *Emerging Adulthood*, 1(3): 185-195. <https://doi.org/10.1177/2167696813475611>
26. Palazzolo F, Bettman C. 2020. Exploring the lived experience of problematic users of internet pornography: a qualitative study. *Sexual Addiction & Compulsivity* 27(1-2): 45-64. <https://doi.org/10.1080/10720162.2020.1766610>
27. Volk F, Floyd CG, Bohannon KE, Cole SM, McNichol KM, et al. 2019. The moderating role of the tendency to blame others in the development of perceived addiction, shame, and depression in pornography users. *Sex Addict Compulsivity* 26(3-4): 239-261. <https://doi.org/10.1080/10720162.2019.1670301>
28. Bóthe B, Tóth-Király I, Potenza MN, Orosz G, Demetrovics Z. 2020. High-frequency pornography use may not always be problematic. *J Sex Med* 17(4): 793-811. <https://doi.org/10.1016/j.jsxm.2020.01.007>
29. Lewczuk K, Nowakowska I, Lewandowska K, Potenza MN, Gola M. 2021. Frequency of use, moral incongruence and religiosity and their relationships with self-perceived addiction to pornography, internet use, social networking and online gaming. *Addiction* 116(4): 889-899. <https://doi.org/10.1111/add.15272>
30. de Ridder D, van der Weiden A, Gillebaart M, Benjamins J, Ybema JF. 2019. Just do it: engaging in self-control on a daily basis improves the capacity for self-control. *Motivation Science* 6(4): 309-320. <https://doi.org/10.1037/mot0000158>
31. Zimmer F, Imhoff R. 2020. Abstinence from masturbation and hypersexuality. *Arch Sex Behav* 49(4): 1333-1343. <https://doi.org/10.1007/s10508-019-01623-8>
32. Nunnally JC. 1994. Psychometric theory 3E. Tata McGraw-hill education.
33. Tangney JP, Baumeister RF, Boone AL. 2004. High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *J Pers* 72(2): 271-324. <https://doi.org/10.1111/j.0022-3506.2004.00263.x>
34. Asendorpf JB. 2002. SGSE. Schüchternheits- und Geselligkeitsskalen für Erwachsene [Verfahrensdokumentation aus PSYNDEX Tests-Nr. 9004392, Autorenbeschreibung und Fragebogen]. Leibniz-Zentrum Für Psychologische Information Und Dokumentation (ZPID)(Hrsg.),

- Elektronisches Testarchiv. Trier: ZPID. <https://doi.org/10.23668/psycharchives.4725>
35. Martin A, Staufenbiel T, Gaab J, Rief W, Brähler E. 2010. Messung chronischer Erschöpfung-Teststatistische Prüfung der Fatigue Skala (FS). *Zeitschrift Für Klinische Psychologie Und Psychotherapie* 39(1). <https://doi.org/10.1026/1616-3443/a000010>
 36. Joseph S, Linley PA, Harwood J, Lewis CA, McCollam P. 2004. Rapid assessment of well-being: The short depression-happiness scale (SDHS). *Psychol Psychother* 77(4): 463–478. <https://doi.org/10.1348/1476083042555406>
 37. Krohne HW, Egloff B, Kohlmann CW, Tausch A. 1996. Untersuchungen mit einer deutschen Version der "Positive and negative Affect Schedule"(PANAS). *Diagnostica-Göttingen* 42: 139–156. <https://doi.org/10.1037/t49650-000>
 38. Engel M, Lincoln TM. 2017. MAP-SR-motivation and pleasure scale-self-report-deutsche fassung. *Leibniz-Institut für Psychologie (ZPID) (Hrsg.), Open Test Archive*. <https://doi.org/10.23668/psycharchives.4649>
 39. Cohen J. 2013. Statistical power analysis for the behavioral sciences. Academic press, pp 1-579.
 40. Fisher RA. 1924. On a distribution yielding the error functions of several well-known statistics. *Proceedings of the International Congress of Mathematics* pp 805-813.
 41. Tyson M, Sloman L, Blass S. 2017. *Eiserner Wille: Mein Leben und die Lektionen von Cus D'Amato*. Blue Rider Press: New York, USA.
 42. Ricci JA, Chee E, Lorandau AL, Berger J. 2007. Fatigue in the US workforce: prevalence and implications for lost productive work time. *J Occup Environ Med* 49(1): 1–10. <https://doi.org/10.1097/O1.jom.0000249782.60321.2a>
 43. Comings DE, Blum, K. 2000. Reward deficiency syndrome: genetic aspects of behavioral disorders. *Prog Brain Res* 126: 325–341. [https://doi.org/10.1016/S0079-6123\(00\)26022-6](https://doi.org/10.1016/S0079-6123(00)26022-6)
 44. Caprara GV, Steca P, Cervone D, Artistico D. 2003. The contribution of self-efficacy beliefs to dispositional shyness: On social-cognitive systems and the development of personality dispositions. *J Pers* 71(6): 943–970. <https://doi.org/10.1111/1467-6494.7106003>
 45. Volkow ND, Wang GJ, Tomasi D, Baler RD. 2013. Obesity and addiction: neurobiological overlaps. *Obes Rev* 14(1): 2–18.
 46. Hou H, Jia S, Hu S, Fan R, Sun W, et al. 2012. Reduced striatal dopamine transporters in people with internet addiction disorder. *J Biomed Biotechnol* 2012: 854524. <https://doi.org/10.1155/2012/854524>
 47. Macit HB, YÜKSEKOKULU TM, Macit G, BAKANLIĞI M, Güngör O, et al. 2019. A research on social media addiction and dopamine driven feedback. *Journal of Mehmet Akif Ersoy University Economics and Administrative Sciences Faculty* 5(3): 882–897. <https://doi.org/10.30798/makuiibf.435845>