Manchester Metropolitan University

e-space

Manchester Metropolitan University's Research Repository

Please cite the Published Version

Germain, J, Leavey, C, Van Hout, MC and McVeigh, J (2021) 2,4 dinitrophenol: it's not just for men. International Journal of Drug Policy, 95. p. 102987. ISSN 0955-3959

DOI: https://doi.org/10.1016/j.drugpo.2020.102987

Publisher: Elsevier

Version: Accepted Version

Downloaded from: https://e-space.mmu.ac.uk/626682/

Usage rights: Creative Commons: Attribution-Noncommercial-No Derivative Works 4.0

Additional Information: This is an Author Accepted Manuscript of an article published in International Journal of Drug Policy by Elsevier.

Enquiries:
If you have questions about this document, contact openresearch@mmu.ac.uk. Please include the URL of the record in e-space. If you believe that your, or a third party's rights have been compromised through this document please see our Take Down policy (available from https://www.mmu.ac.uk/library/using-the-library/policies-and-guidelines)

Title: 2,4 dinitrophenol: it's not just for men

Author names and affiliations

Dr Jennifer Germain*, Dr Conan Leavey*, Professor Marie Claire Van Hout* and Professor Jim McVeigh^

*Public Health Institute, Liverpool John Moores University

^ Department of Sociology, Manchester Metropolitan University

Corresponding author: Dr Jennifer Germain, Public Health Institute, Liverpool John Moores University 3rd Floor Exchange Station, Tithebarn Street, Liverpool , L2 2QP | j.s.germain@ljmu.ac.uk | 0151 231 4500

Declarations of interest: None

Title: 2,4 dinitrophenol: it's not just for men

Keywords: 2,4 dinitrophenol, DNP, online research, women, fat burn, Internet

Abstract

Background

2,4 dinitrophenol (DNP) is an organic compound which causes thermogenesis resulting in fat burning and weight loss. Although not licensed for human consumption, the globalised access to and information about this compound on the internet has prompted a renewed interest in DNP making it readily available to purchase online. Studies into user experiences remain scarce and much of the previous literature has focused on DNP use in male dominated bodybuilding communities. While online accounts of female DNP use are plentiful, this group are under researched.

Method

Ten online forums containing female discussion of DNP were identified and 440 threads subjected to a thematic analysis. Semi structured interviews were conducted with four forum moderators (all men) and one woman who reported use of DNP.

Results

The findings highlighted diverse motivations for why women use DNP as well as differences in experiences, dosing regimens, willingness to take risks and adverse effects. Many women reported using online forums to seek advice and trusted the information they received. However, much of the discussion and protocols for use online is perpetuated by and geared towards men, with DNP seen as a 'hard core' drug that is not suitable for women. Female DNP use was frequently stigmatised because the potential risks were seen to be at odds with women's roles as mothers and caregivers. Women who used DNP were often ignored, ridiculed or seen as novice users, while men were viewed as the DNP experts.

Conclusion

This study provides an overview of female experiences of DNP use. There is a growing body of evidence as to the harms associated with this compound and there are no guaranteed *'safe'* regimens

that can be advocated for any potential user. Users equate deaths or ill harms from DNP with incorrect dosing or insufficient knowledge of the impact of the drug on the body. This leads women to incorrectly assume that if they are not suffering ill effects they are using DNP safely. Of key concern from this study is that within a vacuum of harm reduction advice, women are reported to be accepting DNP advice circulating in male-dominated forums and adopting the protocols of male bodybuilders with potentially fatal consequences. Furthermore, women using DNP are doing so without any 'real world' support, gender sensitive treatment pathways or interventions in place.

Introduction

2,4 dinitrophenol (DNP) is a manufactured odourless yellow chemical first used during World War I in the munitions industry (Grundlingh, Dargan, El-Zanfaly, & Wood, 2011; Petróczi, et al., 2015; Phillips & Singer, 2013). Whilst DNP has been used as a fungicide, preservative and insecticide (Ainsworth, Vargo, & Petróczi, 2018; McVeigh, Evans-Brown, & Bellis, 2012; McVeigh, Germain, & Van Hout, 2017; Politi, Vignali, & Polettini, 2007) it also works as a weight loss agent and was readily available to purchase as such during the early 1930s. During this time, DNP was sold over the counter without a prescription (Cutting, Mehrtens, & Tainter, 1933; Grundlingh, et al., 2011; Tainter, Stockton, & Cutting, 1933; Yen & Ewald, 2012) and heavily targeted at women (Evans-Brown, McVeigh, Perkins, & Bellis, 2012). DNP works by increasing metabolism through inhibiting the mitochondria from making adenosine triphosphate (ATP), which results in heat being produced instead of ATP. This thermogenesis and subsequent fat burning leads to weight loss (McFee, Caraccio, McGuigan, Reynolds, & Bellanger, 2004; McVeigh, et al., 2017). More recently across bodybuilding communities, DNP is recognised as an extremely effective compound for weight loss (Duchaine, 1989; Llewellyn, 2012).

Whilst DNP is reported to cause rapid loss of weight, it is associated with an unacceptably high rate of significant adverse effects (Grundlingh, et al., 2011). It is extremely toxic in overdose, with a classic symptom complex associated with phenol-based products combining hyperthermia, tachycardia, diaphoresis and tachypnoea, eventually leading to death (Petróczi, et al., 2015; Yen & Ewald, 2012). In a recent study of social media posts, the most commonly ingested dose reported was 150 mg (1-2 pills, depending on formulation), followed by 300 mg (2-3 pills) (Chary, Ellango, & Burns, 2020). The lowest published lethal human oral dose of DNP is 4.3 mg/kg, with doses reported in the published acute and suicidal fatalities ranging from 2.8 g to an estimated 5 g. There is a narrow window between the therapeutic effects and the toxic effects of DNP, with significant inter-individual variability in metabolism (Holborow, Purnell, & Wong, 2016).Whilst additional supplements are often advised online to mitigate some of the risks of DNP as well as improve efficacy (including Magnesium, Vitamin C, Vitamin C and Calcium), this information is often not grounded in evidence or is contradictory (McVeigh, et al., 2017).

Due to the identification of harms associated with use, in particular multiple cases of cataracts and linked deaths (Yen & Ewald, 2012), DNP was banned in 1938 by the Food and Drug Administration (FDA). From 1933, when DNP became available as a weight loss agent, up until its ban in 1938 there

were eight reported fatalities (Yen & Ewald, 2012). However, there is now an increasing market for drugs which are seen to improve, hone and perfect the body (Germain, McLean, & Leavey, 2019). Currently, DNP is widely available to purchase online and is often marketed as a safe weight loss drug (Grundlingh, et al., 2011) but it is a metabolic poison and remains illegal to sell as a fat burner within the UK. Deaths linked to DNP have been reported in bodybuilders, sports competitors, extreme dieters and those suffering with an eating disorder (Brooke, 2013; Matharu, 2014; McVeigh, et al., 2017). Despite this, the online market is difficult to regulate due to the anonymity it affords and sellers can easily move from one website to another (Petróczi, et al., 2015). Whilst little is known about the prevalence of DNP use, the increase in the number of DNP related fatalities globally (for instance, 16 in England and Wales between 2001 and 2017, 14 of these post 2012, (Office for National Statistics, 2018) plus a surge in online discussion relating to this drug suggests that its use is rising.

Scholarly articles exist which discuss the female use of other enhancement drugs (e.g. anabolic–androgenic steroids (AAS)), as well as specifically describing the experiences of those discussing their use online and the tensions that arise for women in male dominated spaces (Henning & Andreasson, 2019). However, papers describing the experiences of weight-loss drugs are few. Those papers that do exist tend to focus on bodybuilders or single case studies of DNP use (Ainsworth, et al., 2018; Chan, Peng, & Phua, 2013; McFee, et al., 2004; McVeigh, et al., 2017; Petróczi, et al., 2015) or are specific to sport and doping (Sverkersson, Andreasson, & Johansson, 2020). Research concerning female DNP related fatalities such as Grundlingh, et al. (2011) found that five of the 12 reported deaths since 2002 were women. Additionally, Miranda, McIntyre, Parker, Gary, and Logan (2006) describe the death of a 17 year old woman, believed to be the first reported DNP related death in a non-bodybuilder. However, Petroczi‘s et al. (2015) findings do not comment on the differences between men and women’s experiences and there is no literature available that has focused specifically on female experiences of using DNP. . This research provides an overview of the female use of DNP, focusing specifically on motivations for use, attitudes and perceptions, experiences of using and the role of online communities in sharing advice and knowledge.

Method

Online research can be a valuable method when researching hard to reach or unknown populations (Germain, Harris, Mackay, & Maxwell, 2018) and has been used successfully in previous research exploring online drug communities (Kjellgren, Henningson, & Soussan, 2013; Kjellgren & Soussan, 2011; McVeigh, et al., 2017; Van Hout, 2014; Van Hout & Hearne, 2014a, 2014b). This online research forms part of a larger study exploring all unlicensed weight loss drug use (Germain, 2018).

A systematic approach was taken to identifying relevant online communities (Germain, et al., 2018; Harris, Germain, Maxwell, & Mackay, 2020) using the following key words; 'DNP', '2,4 Dinitrophenol' and 'Dinitrophenol' plus the word 'forum' which were searched online via Bing, Yahoo and Google search engines. Initially 360 forums were identified for inclusion with forums then screened, identifying those with a high proportion of female users, a high proportion of users from the UK and those which were popular forums with a high level of visitors to the site. Care was taken to only include open forums with no registration required (Germain, et al., 2018). Ten forums were selected for analysis. The forums were a body-building forum, two drugs, three weight loss, one health condition and three more general online communities which contained weight loss drug discussion. All threads relating to DNP (N=440) were downloaded using NCapture and exported into NVivo. Any forum user who had used their real name as their user name was removed from analysis. User pseudonyms and country or city identifiers were also removed from transcripts. Quotes were 'Google proofed' to ensure the original post could not be found when searching online for the quote. Whilst this research focused on female experiences, forum posts from men who were discussing female use may have also been included, however it was not always obvious whether the poster was male or female.

Interviews were conducted with four forum moderators (all male) and one woman who uses DNP recruited via the forums. Informed consent was gained and interviews followed a semi-structured interview guide. The interview guide was informed by discussion gathered from online forums. Interviews were recorded using a digital recorder and transcribed verbatim.

A thematic analysis was conducted (Braun & Clarke, 2006). This involved five key steps, reading and re-reading forum threads and interview transcripts for data familiarisation noting early ideas; coding systematically using a data-driven approach supported by NVivo v12, highlighting interesting concepts

and ideas within the data; organisation of codes into groups using an iterative process to develop themes and sub-themes; refining and reviewing of themes by the team, examining patterns across themes and developing a thematic map; and final naming of themes, with quotations from forum posts and interview transcripts representing and articulating the essence of the theme.

Ethical approval for both the forum analysis and interviews was obtained from a University Research Ethics Committee. Full ethical considerations given to this online research project are described elsewhere (Germain, 2018; Germain, et al., 2018; Harris, et al., 2020).

Results

Four key themes were generated which were 1) Perceptions around the use of weight loss drugs, 2) Motivations for DNP use, 3) Experiences of using DNP and 4) Those using DNP.

Perceptions around the use of weight loss drugs

Perceptions and attitudes towards weight loss drugs in general varied considerably. Views frequently differed across the forums and when discussing different types of drugs. Forum moderators' views were similar with perceptions seemingly influenced by the community of which they were a moderator. However, many expressed negative views towards all weight loss drugs arguing that they were merely a quick fix that would not resolve underlying issues.

> *You have unresolved 'over eating' issues with food, once you stop using [a weight loss drug] you'll just go back to stuffing your face without really knowing why.* (Forum user)

> *The only way to lose, maintain or gain body composition is to consume over, equal to or above the number of calories each person needs in a day. No matter what the product claims to do, there isn't a product that could ever change the basic laws of science.* (Forum moderator)

Other women did , argue that weight loss drugs could feature within a weight loss strategy but should not be the only component.

> *DNP will work if you have a very good diet and exercise regimen.* (Forum user)

Even the most powerful weight loss agents such as DNP can only increase metabolism by around 30%. (Forum user)

Many women spoke of the dangers and potential harms of using weight loss drugs. Many were fearful of the side effects or questioned their efficacy.

It's not uncommon to be rushed to the hospital with the Dr ordering ice water shot into your colon because they can't cool you down. (Forum user)

The reason those [drugs] are illegal is because their effective dose is so close to their lethal dose. (Forum user)

Other women spoke about the specific side effects of taking DNP, such as cataracts and cancer. Specifically women discussed the risk of DNP causing problems with fertility. DNP was often perceived to be riskier for women than men and was not considered a 'female drug'.

Besides killing you in less than a day, [it] can also cause cataracts, and cell mutations...hmm cell mutations and oestrogen and breast = cancer. (Forum user)

Sounds like DNP or Dinotrophenol..can only be used by males. It can cause blindness if used by women. (Forum user)

In particular, women often advised against the use of DNP for quick weight loss until the potential user had adjusted their diet and exercise regime. There was great criticism within forum dynamics of women who used DNP when overweight or obese, with members arguing that it was easy to *'out eat'* [1] DNP and the drug would be ineffective without proper diet and exercise.

[1] Using DNP without a calorie deficit / overeating whilst using DNP

Look I've seen other mothers also ask for advice on here and we give them all the same advice.. This isn't what you want. I know it sucks after having a kid with all this extra weight but not having any extra time for the gym you want something you can just take and see pounds come off. (Forum user)

Motivations for DNP use

Motivations for the use of DNP differed. Some users wanted to lose weight and posted logs of their progress, detailing their initial start weight, exercise and diet regimes as well as other supplements they were taking. Forum moderators were generally more supportive of posts where users adopted a whole systems approach to losing weight and did not rely solely on DNP or other weight loss agents. Often in these cases, there would be a back and forth between the moderator in order to *"steer them into a least-harmful usage protocol and attempt a kind of compromise"* (Forum moderator).

I am not a body builder. I am running DNP to lose weight. I am sick of being fat, dieting all the time, plateauing. I am 27/F/4'10"/136 lbs. I'm not sure what my ultimate weight goal is but 115 lbs or less. I started DNP this week for a few days to see how my body reacted. I am barely having side effects at all, so I'm motivated to post a quick log to get feedback. (Forum user)

Others discussed how their weight loss had plateaued and they were using DNP to kick start their weight loss.

I'm only using them because I have plateaued in my weight loss and need a boost. (Forum user)

I honestly know that there is something metabolically wrong with me. So after much reading and contemplating, I decided to try low dose DNP. I have purchased crystal DNP, 250mg, from the well-known supplier. (Forum user)

Some women were frustrated that traditional weight loss strategies had not been effective and this had led them to use, or consider using, DNP. Other women used DNP to help them cut [2] weight in time for fitness or bodybuilding competitions.

> *Are you talking about fat burners? I have thought about taking some before. I think they might be useful when on a tight schedule, e.g. prepping for a bodybuilding competition.* (Forum user)

> *I had decided to do a competition and I hadn't given myself quite enough time to do it and when I realised that I was faced with the decision of don't do it, pull out or do something a bit radical to speed the process up…but, yeh, the DNP use was a decision made, it was either do that or don't do your competition and I decided to try it. (user of DNP)*

Some women spoke of achieving specific goals such as '*getting abs'* or '*lowering their body fat'*. In these cases, women were often already physically fit but used DNP for an extra edge.

> *I'm a bit greedy [laughs]… I was like, ok cool, I have an alright body... let's see if I can get abs! But I have to lower my body fat percentage for that. I've been trying to do some body re-composition for a bit and DNP is pretty much perfect for this.* (Forum user)

Women often appeared conflicted about whether to use DNP. They often cited weight loss as the potential benefits whilst still voicing concerns about side effects. One forum member discussed how she had discarded DNP due to fear over cataracts but was feeling tempted to try again.

> *I just read up on DNP because I never heard of it; it does not sound pleasant, says the angel on my left shoulder but losing half pound a day would be tempting, says the devil on my right shoulder*. (Forum user)

[2] Period when in calorie deficit to lose fat or weight. Often done in run up to bodybuilding competition.

> *I have thought of taking DNP or Clenbuterol/T-3 to reach five to six per cent body fat. I have some pro body builder friends that have done it but man do they say some scary stuff about DNP.* (Forum user)

Some women described how they felt it was impossible to lose weight and felt they had no other option, with one forum member arguing that she would rather "*feel somewhat miserable for 20 days than miserable throughout my life"* (Forum user).

Some women spoke about how they felt pressured into using DNP by others around them. In some cases, this was because they noticed other women using DNP were achieving the bodies they themselves desired. This was seen across bodybuilders and dieters and those in their cutting phase for competitions as well as those looking for a quick boost to their weight loss.

> *I am in my cutting phase but want to know if it's possible to successfully diet without the aid of diet pills? It seems everyone that is cut and ripped nowadays uses some sort of diet pill.* (Forum user)

Some women spoke about how DNP had been recommended to them by fitness trainers and this had influenced their decision to use.

> *I'm a female, 5"3 and just over 120lbs. I started using DNP because some of my trainers from my fitness club mentioned using it to get rid of fat. I bought them from the same trusted dealers they use.* (Forum user)

Women spoke about how they would not use DNP because they are unlicensed for human consumption.

> *They are illegal street drugs, not meant for human consumption. That means they ARE well regulated.and it is illegal to sell them as diet pills.* (Forum user)

> *Hasn't DNP been illegal for weight loss since 1938?* (Forum user)

Often women talked about how they felt that the drugs were effective but that they were dissuaded from using them because they were not legal. In some cases, members talked about how they were sports competitors or bodybuilders and were required or preferred to stay natural. In some cases, discussion was shut down quickly due to DNP's legal status. However, both forum moderators and users of DNP agreed usage was much higher in bodybuilding circles, although it was generally not spoken about openly. As one women put it, *"even if you offer them anonymity they will not admit it to anybody"* (user of DNP).

> *I get plenty of messages from so called natural bodybuilders asking about [DNP]. Nobody is a natural bodybuilder, there's no such thing. The competitions are always rigged by somebody who cycles. (Forum moderator)*

> *DNP is banned. It is for research purposes and not appropriate to talk about on this forum, and it CAN KILL YOU.* (Forum user)

There was recurring discussion around DNP killing people and many women argued that those who used it were stupid to risk their life. Much attention was given to media reports of those who had died following DNP use.

> *DNP can kill you.* (Forum user)

> *A girl in the UK died a few days ago taking some diet pills she got off the Internet. Even though she managed to get herself to hospital they could not do anything to save her and doctors could only watch her burn up from the inside out.* (Forum user)

Experiences of using DNP

Much discussion on online forums focused on women's experiences of using DNP. Many women reported positive experiences of using DNP with some discussing how it was far more effective than other weight loss drugs.

I used a lot of different things...the only things that actually worked though were ones that were considered black market. (Forum user)

It (DNP) just beats the pants off every other FDA approved weight-loss drug, including orlistat, sibutramine and rimonabant. (Forum user)

DNP efficacy was often equated with maximum weight loss and minimum side effects. Whilst DNP was considered to be effective, users should be aware of complementary supplements to counteract side effects and increase water consumption.

Then there is DNP it's literally like drinking rat poison, but it really burns fat. You need supplements when using it just to not die, and if you don't hydrate or overheat you WILL die. (Forum user)

There was also some discussion concerning how the use of these drugs had helped women to feel more confident and were considered life changers for those using them.

I have had some great compliments and my weight loss really has changed my life so much, in every sense, from the jobs I want to do, the confidence I have and the courses I've taken. (Forum user)

Some women felt that despite side effects, the weight loss they had achieved through the use of DNP meant its use was justified.

I got all the sides: extreme thirst, sleepless nights, lethargy, and the worst- extreme sweating!... I'm extremely happy with the results, I was hoping for 7lbs, and I'm a month out of my cycle and have easily kept that weight off. (Forum user)

Most forums seemingly operated in a legitimate way and were invested in the safety of the forum users and this was evident in interviews with forum moderators. However, one forum moderator admitted selling DNP through the forum and removed posts which discussed the negative elements of DNP.

> *A lot of times I do shut down naysayers not because they're wrong or anything like that but I say it because I want to make sales (laughs).* (Forum Moderator)

Most frequently, women either used DNP and reported positive experiences or had never used and advised against it due to potential side effects.

> *DNP is bad news. I don't know loads about it but a friend took it as recommended and after researching it for 6 months and nearly killed herself.* (Forum user)

DNP side effects most commonly reported were overheating and sweating. Additional side effects discussed included diarrhoea, constipation, hives and irregular menstrual cycle.

> *Dosed this afternoon and had to put a towel on my office chair to prevent me sticking to it. Washing spare bed sheets so I can change the sheets on the bed. Noticed some shortness of breath in the evening. Slept ok, but sheets were soaked still.* (Forum user)

Others reported suffering no side effects following the use of DNP or stated that the side effects they had experienced were manageable.

> *I'm feeling pretty good. I haven't experienced any heat or sweating yet. I might be a hair warmer today, but I am wearing a thick sweater so who knows. Sleeping great. No stomach issues.* (Forum user)

Some women reported feeling judged if they admitted to others they had used weight loss drugs. In these instances, it was felt that other people did not understand their reasons for taking them and thought they should diet and exercise instead. When discussing DNP in particular, women appeared to

be frustrated with other forum users who *'hadn't done their homework'* and assumed they were looking for a quick fix by risking their health.

> *Are you actually mentally retarded? If you don't know the BASICS of DNP how do you expect to run it and not completely Shrek yourself? How about before using a lethal substance you try putting the fork down and not being a fat land whale.* (Forum user)

There was much discussion on forums about where women should and should not purchase weight loss drugs. Many women purchased their drugs online, often after having recommendations by other forum users. Price and convenience were often cited as the main reasons for purchasing online although the women were aware that buying online came with risks. However, many of the forums had a ban on discussion around purchasing and women on the forum repeated this message to those looking to purchase.

> *Hey, do you mind telling me where you got yours from at all? I cannot seem to get replies from [seller name], or anyone! I'm about ready to tear my hair out!* (Forum user)

> *This is NOT a web site for scoring illegal drugs. Online pharmacy links like you're looking for are deleted here as fast as they get posted. You sound like a kid looking for some speed. I suggest you seek help for yourself before you end up in trouble.* (Forum user)

Those using DNP

Many forum members argued that DNP should only be used by those who were in the bodybuilding community due to the dangers associated with its use. Furthermore, some members argued that drugs like DNP would only be effective for bodybuilders or athletes.

> *It's a really dangerous drug, it's not to be used for people that don't have experience in the bodybuilding industry*. (Forum user)

A national champion bodybuilder probably using drugs like clenbuterol, T3, DNP, etc [should] help with their weight loss, but for the rest of us, any effect from it will be so small it's not worth worrying about. (Forum user)

Many forum users only associated DNP with bodybuilders or elite athletes arguing that advice on drug taking from these groups were not suitable for the 'average person'.

A high-level or pro bodybuilder is the worst possible person for the average person to take advice from. Firstly, they have superior genetics in the first place (or they wouldn't be competing at that high a level). Secondly, they're about 99% likely to be juiced to the gills (on steroids/PEDs). (Forum user)

Others argued that it should only be used by those who had an understanding of the pharmacological properties of the drugs.

DNP is not safe for kids, or anyone without proper knowledge of chemicals. (Forum user)

There was widespread consensus that DNP should be well researched and respected by those who use it and should really only be used by people who know what they are doing.

If you KNOW what you're doing and are realistic about what to expect then DNP is a very powerful, powerful fat loss drug. (Forum user)

Forum members were often very critical of what they classed as 'novice' or 'newbie' people using DNP. There were many instances across forums where women would ask about using DNP and were told it was not suitable for them to use. Others appeared frustrated with new users' apparent lack of knowledge or respect for the drug.

You can lose 20 lbs in 11 weeks with just good diet and OTC fatburners. I don't see the need to go as far as DNP to lose 8 lbs, esp as a first time competitor. (Forum user)

Often new forum members posing questions about DNP drug use were met with conflicting and in some cases incorrect advice. Moderators also discussed having to navigate and react quickly to incorrect information particularly when forum posters were advocating "*frankly dangerous and/or harmful protocols"* (Forum moderator).

> *Do you really want to be suggesting DNP(2,4-Dinitrophenol) and Clenbuterol to the OP? She's a first-time competitor trying to lose 7-8 lbs and you suggest Anabolic steroids to her? Are you serious?!* (Forum user)

> *These people who say don't drink while you're on DNP like woah woah woah you're going to die, absolutely going to die…they recommend these things and I usually shut them down…they're completely counter to the advice I give.* (Forum moderator)

> *There's also a huge amount of bro-science which is just my mate in the gym said to do this so I do. There's also a lot of idiots who jump onto the bandwagon of I'm going to be a personal trainer or I'm going be a prep coach and they do one show and they think that they're an expert and they're really not.* (user of DNP)

Much discussion centred around the idea that uninformed users ruined DNP for everybody else. Many argued that those who used DNP incorrectly, took a too high dose or had not done their research exacerbated negative attitudes towards this drug. Media reports of deaths following the use of DNP were also discussed and in some cases the argument was made that those using had not died from using the drug but rather from using the drug incorrectly.

> *Did she die from the pills? Or from taking too many of the pills?* (Forum user)

> *Yeah, natural selection at its best.* (Forum user)

There were instances where it was argued that DNP was not suitable for women. Whilst this research focused upon female discussion, male discussion of the female use of DNP was also evident. In some cases, male forum members discussed how they did not want their girlfriend or wife to use DNP due to

increased risk of side effects or because they thought they were using DNP for the wrong reasons. In some cases, members discussed a woman's role as a mother and how her risking her safety would affect her child.

> *You sound like a young inexperienced woman trying to lose weight the easy way. This is not for you.* (Forum user)

> *I did discuss DNP with my girlfriend and she wanted to try it. Initially she just saw it as "fast" weight loss. Loose 10lbs in a week? Sign me up! I'll take twice as much and loose 20lbs! It's this reckless attitude that is the exact reason I will not allow her to take it.* (Forum user)

> *DNP is dangerous.. very dangerous.. and with a son if you do something wrong he will be without a mother.. or if something bad happens who will watch him while you're in a hospital or if you have PN [peripheral neuropathy] and can't walk, who will play with him.* (Forum user)

Many women discussed the lack of information available for women who were using DNP and the lack of female experiences and perspectives. Similarly, forum moderators discussed how advice given was usually based on what would be considered a normal dosage regime for men.

> *Online we need more DNP experiences by women so hello there.* (Forum user)

> *I researched DNP really well, but there are few testimonies for women.* (Forum user)

> *We advise based on a male norm model. Basically every bit of advice you'll ever find is about how it works in a man which is different for how it works in a women and we might be saying oh take 250 to start whereas for a woman that's going to make you throw up your guts.* (Forum moderator)

Whilst women providing information on drug cycling and logs were generally received positively, there were instances where women felt that their DNP use was being judged negatively simply because they

were a woman. Forum moderators were also aware of this saying that some women had been driven out of forums and switched to *"private Facebook groups"* due to forums being *"pretty hostile places".* The woman who used DNP who was interviewed had experienced similar *"chauvinistic attitudes"* from moderators and an overwhelming sense of the forums being *"heavily biased towards men".*

> *I'm a female and thank you for publishing this log. It's great to have multiple resources. I've been having trouble figuring dosage for women.* (Forum user)

> *I saw 2 men discussing who were obese and using DNP to lose weight. Nobody had a go at them. Nobody called them names or said they were lazy. Nobody questioned their diet or eating habits. Yet I get totally blasted because I'm using DNP as an aid to help lose some weight. I think you may have a problem with women.* (Forum user)

Discussion

There is limited research examining which groups of individuals, outside of bodybuilding communities, are likely to use DNP. Furthermore, online markets most often target DNP at bodybuilders and several deaths following DNP use have been identified in bodybuilders (Grundlingh, et al., 2011). Other research exploring DNP use has done so without exploring the sex or other characteristics of users (McVeigh, et al., 2017) although there is evidence that DNP is to a lesser extent used by extreme dieters and those suffering with eating disorders (Hoxha & Petroczi, 2015). However, this online research found that female discussion of DNP is visible and plentiful, both inside and outside bodybuilding communities.

Many women found using DNP had the desired effect citing such changes as 'increased energy', 'weight loss', 'suppressed appetite' and 'increased confidence' following weight loss. Even some women who experienced side effects considered these *"par for the course*" and worth it, if it meant they lost weight. Most commonly reported side effects were overheating, sweating, diarrhoea, constipation, hives and an irregular menstrual cycle highlighting the side effects and potential risks women are willing to take in order to lose weight. However, it is important to remember that the data presents self-reported effects of DNP that cannot be confirmed, nor can we know the role of the nocebo and placebo effects in generating these perceived effects.

Whilst advice on how to use DNP was frequently shared on online forums in reality there is very little evidence concerning how to use DNP safely as there have been no clinical trials testing its efficacy. Therefore, the information on online forums is based on experiences rather than evidence and is also often based on a male norm model. What may be a 'safe' dose for a male bodybuilder is likely to be different to what is safe for an overweight woman, or even a female bodybuilder. Other advice circulating on forums concerning DNP suggests using supplements to minimize harms, even though is no clinical evidence that supplements do reduce harm, a finding found elsewhere in other areas of human enhancement where women were described as using human growth hormone to aid training recovery (Van Hout & Hearne, 2016).

DNP is not licensed for consumption, however this has not prevented women from using it. Instead, women are placing their trust in the internet for both gaining advice and purchasing drugs. These drugs may be adulterated, not contain correct information on dosing or may pose a risk of drug interactions. Furthermore, women will be using these drugs without health care professional supervision. Due to a lack of knowledge about who uses DNP and why, there is also nothing in the literature which explores the public health implications of DNP use in women, or on gender sensitive harm reduction or health intervention strategies. Furthermore, communicating the risks of DNP use to individuals using it for weight loss remains a challenge, as likelihood of death from DNP is subject to many variables in addition to dosage, such as health of individual, underlying conditions. Equally concerning is that prevalence of use of this compound has not been estimated and we can only speculate on its use based on the volume of discussion it generates on the internet.

There was also a clear divide between those women using DNP for bodybuilding and those using for general weight loss. The internal body ideals of bodybuilding women are more muscular than the mainstream and achievement of these body goals confers important boosts to self-confidence and self-esteem (Grogan, Evans, Wright, & Hunter, 2004). According to Bunsell (2013), body building women seek advice from trusted peers and those deemed knowledgeable by the community and downplay the risks of image and performance enhancing drugs in the pursuit of enhanced muscularity. While many bodybuilding women experience side effects from taking compounds, they manage these by keeping drug dosages low and cycles short, and for most the satisfaction of body building outweighs any

negatives (Bunsell, 2013, pp. 91-96). As such, bodybuilding women may be more highly motivated to use DNP than women using it for generalised weight loss, they may invest more time researching effective doses via the bodybuilding community, and more willing to tolerate side effects and minimise risks in pursuit of a muscular ideal. This posits their motivations and experience are similar to male bodybuilders who are using DNP (Ainsworth, et al., 2018), however they may face additional criticism for using what is perceived as a 'male' drug.

This research demonstrates that there is an unwillingness for those using DNP to discuss their drug use with those in their 'offline life' such as family members, friends and also health care professionals due to fears of judgement, embarrassment or stigma. Whilst stigma is associated with all enhancement drug use for all types of users (Coomber & Salinas, 2019) leading to hiding of use, this is heightened for women, as engaging in risky 'appearance' driven behaviours may be deemed to be at odds with their role as mothers or caregivers, something which is also evident for women engaging in traditional drug use (Radcliffe, 2011). This creates barriers for women to access support or health care services due to the perceived tension between their drug use and gendered expectations (Lee & Boeri, 2017). Therefore, women are discussing their use online, adopting the protocols of use of male bodybuilders with potentially fatal consequences.

This stigma was also evident online. There are currently very few online spaces for women that offer reliable and informative harm reduction advice in a non-judgemental way. Online communities were either male dominated, offering advice on harm reduction but dismissive of female voices, or female dominated but with users who had very little experience of DNP. This is an issue for other online communities discussing enhancement drugs whereby women inhabit predominantly male spaces resulting in 'cultural manspreading' and offering little support for female practices and protocols (Henning & Andreasson, 2019). Hence there is a population of naïve users who are receiving online advice based on anecdote not evidence and following protocols shaped by the experience of men, often body builders.

This research highlighted the means women will go to in order to achieve the body they desire. Anxiety over well know side effects and knowing the potential for significant harm, including death, does not always deter women from using DNP. The trust women place in others online is also evident with many using online forums to seek advice from other members, naively regarding them as DNP experts. Whilst

online spaces which encourage female input and offer information and advice may reduce harm and even deter some women from using DNP, this research found online information which was deliberately misleading or hidden in order to boost DNP sales. Those currently providing advice may not always be the best suited for this role and engaging people who are using DNP needs to be reclaimed as part of a wider health agenda, something that has been lacking due to DNP not being licensed. Health care professionals in general, but especially GPs, need to be aware of a thriving online market for unlicensed weight loss drugs and be vigilant for the presentation of harms associated with DNP drug use.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors

Reference

Ainsworth, N. P., Vargo, E. J., & Petróczi, A. (2018). Being in control? A thematic content analysis of 14 in-depth interviews with 2, 4-dinitrophenol users. *International Journal of Drug Policy, 52*, 106-114.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*, 77-101.

Brooke, C. (2013). Tragedy of the gifted rugby player, 18, who died after buying deadly 'fatburning' pills online. In *Daily Mail*. https://www.dailymail.co.uk/news/article-2421042/Fat-burning-pills-sold-online-kill-promising-young-rugby-ace-Chris-Maplecroft-18.html.

Bunsell, T. (2013). *Strong and hard women: An ethnography of female bodybuilding*: Routledge.

Chan, W. L., Peng, E., & Phua, D. H. (2013). Dangers of 2,4-dinitrophenol as a weight loss agent: A case report. *CLINICAL TOXICOLOGY, 51*, 280-281.

Chary, M., Ellango, K., & Burns, M. (2020). Patterns of 2,4-Dinitrophenol Use as Discussed on Social Media. *medRxiv*, 2020.2004.2026.20080382.

Coomber, R., & Salinas, M. (2019). The supply of Image and Performing Enhancing Drug (IPED) to local non-elite users in England. In K. van de Ven, K. J. D. Mulroooney & J. McVeigh (Eds.), *Human Enhancement Drugs*. London: Routledge.

Cutting, W., Mehrtens, H., & Tainter, M. (1933). Actions and uses of dinitrophenol. *JAMA, 101*, 193-195.

Duchaine, D. (1989). *Underground Steroid Handbook II*. United States: Modern Bodybuilding Publications.

Evans-Brown, M., McVeigh, J., Perkins, C., & Bellis, M. (2012). Human Enhancement Drugs -The Emerging Challenges to Public Health. In: The Centre for Public Health.

Germain, J. (2018). *One Size Does Not Fit All: A Qualitative Study Exploring Unlicensed Weight Loss Drug Use In Women.* Liverpool John Moores University, http://researchonline.ljmu.ac.uk/id/eprint/9617/.

Germain, J., Harris, J., Mackay, S., & Maxwell, C. (2018). Why should we use online research methods? Four doctoral health student perspectives. *Qualitative health research, 28*, 1650-1657.

Germain, J., McLean, C., & Leavey, C. (2019). One size does not fit all: tackling the issue of weight loss drug use. In K. van de Ven, K. J. D. Mulroooney & J. McVeigh (Eds.), *Human Enhancement Drugs*. London: Routledge.

Grogan, S., Evans, R., Wright, S., & Hunter, G. (2004). Femininity and Muscularity: Accounts of Seven Women Body Builders. *Journal of Gender Studies, 13*, 49-61.

Grundlingh, J., Dargan, P. I., El-Zanfaly, M., & Wood, D. M. (2011). 2, 4-dinitrophenol (DNP): a weight loss agent with significant acute toxicity and risk of death. *Journal of medical toxicology, 7*, 205.

Harris, J., Germain, J., Maxwell, C., & Mackay, S. (2020). The Ethical Implications of Collecting Data From Online Health Communities. *SAGE Research Methods Cases*.

Henning, A., & Andreasson, J. (2019). "Yay, Another Lady Starting a Log!": Women's Fitness Doping and the Gendered Space of an Online Doping Forum. *Communication & Sport*, 2167479519896326.

Holborow, A., Purnell, R. M., & Wong, J. F. (2016). Beware the yellow slimming pill: fatal 2, 4-dinitrophenol overdose. *Case Reports, 2016*, bcr2016214689.

Hoxha, B., & Petroczi, A. (2015). Playing with fire? Factors influencing risk willingness with the unlicensed fat burner drug 2, 4-Dinitrophenol (DNP) in young adults. *Public health, 129*, 1519-1522.

Kjellgren, A., Henningson, H., & Soussan, C. (2013). Fascination and Social Togetherness-Discussions about Spice Smoking on a Swedish Internet Forum. *Sustance Abuse, 27*, 191-198.

Kjellgren, A., & Soussan, C. (2011). Heaven and Hell - A Phenomenological Study of Recreational Use of 4 HO-MET in Sweden. *Journal of Psychoactive Drugs, 43*, 211-219.

Lee, N., & Boeri, M. (2017). Managing Stigma: Women Drug Users and Recovery Services. *Fusio : the Bentley undergraduate research journal, 1*, 65-94.

Llewellyn, W. (2012). *William Llewellyn's Anabolics 10th Edition*. Florida: Molecular Nutrition.

Matharu, H. (2014). Body-building obsessed UCA Epsom student Sarmad Alladin killed by deadly DNP tablets. In *Your Local Guardian*.

McFee, R. B., Caraccio, T. R., McGuigan, M. A., Reynolds, S. A., & Bellanger, P. (2004). Dying to be thin: a dinitrophenol related fatality. *Veterinary And Human Toxicology, 46*, 251-254.

McVeigh, J., Evans-Brown, M., & Bellis, M. A. (2012). Human enhancement drugs and the pursuit of perfection. *Adicciones, 24*, 185-190.

McVeigh, J., Germain, J., & Van Hout, M. C. (2017). 2, 4-Dinitrophenol, the inferno drug: a netnographic study of user experiences in the quest for leanness. *Journal of Substance Use, 22*, 131-138.

Miranda, E. J., McIntyre, I. M., Parker, D. M., Gary, R. D., & Logan, B. K. (2006). Two Deaths Attributed to the Use of 2,4-Dinitrophenol. *Journal of analytical toxicology, 30*.

Office for National Statistics. Dinitrophenol (DNP) related deaths occurring in England and Wales, 2001 to 2017. Retrieved 26/08/2020 2020 from https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/adhocs/009329dinitrophenoldnprelateddeathsoccurringinenglandandwales2001to2017.

Petróczi, A., Ocampo, J. A. V., Shah, I., Jenkinson, C., New, R., James, R. A., Taylor, G., & Naughton, D. P. (2015). Russian roulette with unlicensed fat-burner drug 2, 4-dinitrophenol (DNP): evidence from a multidisciplinary study of the internet, bodybuilding supplements and DNP users. *Substance abuse treatment, prevention, and policy, 10*, 39.

Phillips, L., & Singer, M. A. (2013). Peripheral neuropathy due to dinitrophenol used for weight loss: something old, something new. *Neurology, 80*, 773-774.

Politi, L., Vignali, C., & Polettini, A. (2007). LC-MS-MS analysis of 2, 4-dinitrophenol and its phase I and II metabolites in a case of fatal poisoning. *Journal of analytical toxicology, 31*, 55-61.

Radcliffe, P. (2011). Substance-misusing women: Stigma in the maternity setting. *British Journal of Midwifery, 19*, 497-506.

Sverkersson, E., Andreasson, J., & Johansson, T. (2020). Sis Science' and Fitness Doping: Ethnopharmacology, Gender and Risk. *Social Sciences, 9*.

Tainter, M. L., Stockton, A. B., & Cutting, W. C. (1933). Use of dinitrophenol in obesity and related conditions. A progress report. *JAMA, 101*, 1472.

Van Hout, M. C. (2014). SMART: An Internet study of users experiences of synthetic tanning. *Performance Enhancement and Health*.

Van Hout, M. C., & Hearne, E. (2014a). Confessions of contemporary English opium-eaters: a netnographic study of consumer negotiation of over-the-counter morphine for misuse. *Journal of Substance Use*, 1-12.

Van Hout, M. C., & Hearne, E. (2014b). "Vintage Meds": A Netnographic Study of User Decision-Making, Home Preparation, and Consumptive Patterns of Laudanum. *Subst Use Misuse*.

Van Hout, M. C., & Hearne, E. (2016). Netnography of Female Use of the Synthetic Growth Hormone CJC-1295: Pulses and Potions. *Subst Use Misuse, 51*, 73-84.

Yen, M., & Ewald, M. B. (2012). Toxicity of weight loss agents. *Journal of medical toxicology, 8*, 145-152.