Laughter Yoga - a Positive Psychology Intervention: User Experiences and Effects on Mental Well-Being, Self-Compassion and Health Promoting Behaviors

Selene Robena Illner

M.Sc. Thesis

'Health Psychology and Technology'

Supervisors:

dr. Stans Drossaert

dr. Marcel Pieterse

November 2019

Faculty of Behavioural, Management and Social Sciences

UNIVERSITEIT TWENTE.

Abstract

Background and objectives

The benefits of laughter for mental and physical health are known. Additionally, Laughter Yoga, a simulated form of laughter gets increasing attention worldwide. However, scientifically, there is still a huge lack of evidence of this positive psychological intervention (PPI) in both theoretical and empirical grounds. The aim of the present study is to seek evidence about the experience of LY and its effectiveness on different concepts.

Design

A quasi-experimental pre-post design with an intervention group and a non-randomized waitlist- control group (WLC) was employed.

Methods

Participants (≥18 years) were assigned to the LY (N=24) or the wait-list control group (N=24). Four LY sessions, each lasting 30 minutes, were given twice a week for a duration of two weeks. At baseline and shortly after the intervention period, data were collected on the outcome variables (1) mental well-being (primary outcome) (2) self-compassion (secondary outcome) and (3) health promoting behavior (secondary outcome). Repeated measures ANCOVA (2 group by 2 time) were applied to test whether there was an impact of LY on primary and secondary outcomes. The motivation and the mood of the participants in the LY group was assessed by using repeated measures ANOVA. Furthermore, a mediation analyses with the PROCESS tool was implemented to examine whether self-compassion might be an underlying working mechanism between the effects of LY on mental well-being. Finally, a semi-structured interview with two participants of the study at hand was conducted about their motivation, experience and perceived psycho- physiological effects, a few days after the intervention period.

Results

Participants in the LY group did increase on the subscale emotional well-being ($p < 0.01$) compared to the control group. After ruling out the confounding variables of age and experience in yoga, self-compassion was non-significant ($p= 0.06$). No significant enhancements of health promoting behavior (including alcohol and smoking) were found, compared to the control group ($p=0.87$). Self-compassion was not a mediator between the relation between LY on mental well-being. The motivation average was high, but it did not increase over time. The mood of the participants from pre-post for each LY session significantly increased ($p<0.001$). Finally, the majority of participants was very positive about the intervention.

Conclusions

On the basis of this study it can be concluded that LY may be a suitable positive, psychological intervention enhancing hedonic well-being. Additionally, it may be of value to incorporate elements of self-compassion or health promoting behavior in a LY session in order to make the intervention more effective.

Keywords: positive psychology, positive psychological intervention, simulated laughter, laughter yoga, mental well-being, self-compassion, health promoting behavior, salutogenesis

Preface

Many would think, that the inclusion of a Preface is only necessary when writing a book or a dissertation. I disagree. For me this paper is about my passion and makes me proud, which in my opinion is worth to be mentioned in a Master thesis, too. Also, I want to let others know, how I came to the topic, Laughter Yoga and what it has made with me.

In January 2016, when I first participated in a Laughter Yoga workshop, I did not know how many doors this activity was going to open me. Ironically, I hated it but loved it at the same time. Laughter Yoga (including being a participant myself, an instructor and a researcher) sometimes really pushed me out of my comfort zone, but I knew, that it was good for me and if I continued with it, it would made me personally grow. As claimed by Friedrich Nietzsche: *'That which does not kill us makes us stronger'.* Thus, I jumped into the cold water and reached my goals step by step. First, by overcoming my inhibitions during Laughter Yoga as a participant. Second, by getting a certificate in order to show Laughter Yoga to others. Last but not least, of course, by writing a Master thesis about it. Latter mentioned gave me the chance to take a critical look behind the scenes and to understand the different facets of this positive psychology intervention. There still so much I want to know and explore, but this is for another time ☺ .

Acknowledgements

This text is a piece of gratitude for all amazing individuals that supported me realizing my goals around Laughter Yoga: First of all, Madan Kataria**,** thank you for creating this wonderful intervention and spreading it around the world. Namaste! Madhavi, ich bin so froh, dass ich bei dir die Ausbildung absolviert habe und von dir lernen durfte. Deine Art und Weise wie du Lach Yoga unterrichtest, find ich toll. Ohne dich, hätte ich wohl nie so eine tiefe Verbundenheit mit Lach Yoga entwickeln können. Du bist eine Art Guru für mich ☺ Joke, sinds 2017, mocht ik regelmatig aan je deur kloppen en de Ballet Studio laten reserveren voor de workshops. Hartelijk dank, voor je ondersteuning van mijn 'Lach Yoga carrière' en voor de promotie daarvan. Dimensie, mijn studievereniging, dank voor de openheid voor Lach Yoga en dat ik sinds drie jaar voor jullie workshops mag geven. Prem Samadhi, jij was een grote steun vooral aan het begin van mijn workshops aan de Universiteit Twente. Dankje van harte, dat je er voor me was. Femke, Rob, Linda, Karin, Henning and Fatma you all inspired me for my workshops or my thesis. Many thanks!

My participants**,** without your effort and help, I could not have accomplished this Master thesis. You were reliable and did not let me down. Your feedback was not only valuable for this research but also for me personally. Your energy during the sessions was amazing, and I enjoyed

giving the classes to you. I hope you got inspired by Laughter Yoga, too. Also, a warm thank you to my participants in the control group, for your patience and reliability. I know that the questionnaires were long, but you all did it, thank you! Additionally, many thanks to the Sport und Gesundheitszentrum in Gelsenkirchen (especially Bert) and the Fachhochschule Gelsenkirchen (especially Betty), that provided with the room facilities.

Stans, mijn eerste begeleider, ik ben heel blij, dat je open stond voor het onderwerp Lachyoga en dat je bereid was deze these te begeleiden. Daarmee heb je me de mogelijkheid gegeven om mijn passie te volgen en daar ben ik je heel dankbaar voor. Af en toe, moest je me 'back to earth' brengen, bijvoorbeeld als mijn interpretatie van de resultaten toch iets te creatief werd. Soms, heb ik je het met mijn 'wetenschappelijke' schrijfstijl niet altijd makkelijk gemaakt. Dankzij jou kritische, maar goed bedoelde adviezen heb ik kunnen groeien in het academisch veld. Ik hoop dat ons tijd je in goede herinnering zou blijven hangen. Bedankt voor al je geduld. Marcel, mijn tweede begeleider, je straalt zoveel rust uit en dat vond ik heel fijn tijdens de begeleiding. Het heeft een positieve invloed op mij eigen ontspanning gehad en me vaak geholpen een 'clear mind' te krijgen. Ook je adviezen waren heel handig en hebben me een veel verder gebracht in mijn denkprocessen. Dank voor je indirecte mentale steun en ook je waardevolle feedback!

My (long-lasting) friends and (previous)housemates, I cannot name you all here, but I hope you know that I mean you. Knowing you were there, standing behind me and making me feel home, had giving me a lot of strengths; Not only for my academic career but also in different life phases. Thank you all. Leon, mein gesellschaftlicher Auftrag ist vollbracht (insider). Es gibt viel wofür ich dir danken möchte…Die Nächte in der Bibliothek, die abendlichen 'Motivation talks' im Calslaan, oder die anfänglichen Lach Yoga workshops; Du hast mir so oft Mut gegeben in Momenten, wo ich zweifelte und mich verkriechen wollte. Du bist nicht nur mein statistischer Fels in der Brandung und mein Personal Promoter für Lach Yoga gewesen, sondern auch ein guter, aufbauender Freund. Unsere Freundschaft hat mich in vielerlei Hinsicht bereichert. Danke! Nadja, ich kann nicht in Worte fassen, wie dankbar ich dir bin. Vom Moment im Psychodiagnostikkurs, bis heute, egal wann ich eine Frage hatte oder deinen Rat brauchte, du warst IMMER für mich da. Du hast mir nie das Gefühl gegeben unerwünscht zu sein. Auch wenn du mich manchmal mit deinem kritischen Blick auf meine These fertig gemacht hast, weiß ich, dass es nur zu meinem Besten war. Und du kannst sehr gut backen ☺ Danke einfach für alles! *De goede* Michiel, voor mij heb je veel goed's gedaan waarvoor ik je dankbaar ben. *De goede*

feedback op mijn introductie en discussie. *De goede* tijd en gesprekken (bijvoorbeeld in het UT zwembad). *De goede* promotie voor Lach Yoga onder je PhD collega's; Deze groep heeft me zo veel positieve energie gegeven. Tot *de goede* slot, waar ik je vooral wil danken is, dat je me indirect in herinnering hebt geroepen dat dat, wat ik eigenlijk anderen wil leren, zelf in mijn eigen leven toe moet passen. Dus, ook al explodeert het hoofd en liep de scriptie vast, gewoon "whatever" zeggen (Lach Yoga oefening). Bedankt voor het herinneren van deze wijsheid. Very good, very good yeah! ☺ Valentin**,** unsere Freundschaft bedeutet mir viel. Du hast auch viel positiven Einfluss auf mein Master Studium gehabt, auch wenn es dir vielleicht nicht ganz bewusst ist. Zudem bin dir sehr dankbar für deinen kritischen Blick, in Bezug auf Lach Yoga, der mir viele, gute Denkanstöße gegeben hat. Danke! Isaac, here an intelligent fact (insider): The laughter moments with you (even independent of Laughter Yoga) have a significant influence on my mental well-being ;) Your presentation advices and general feedback helped me a lot. Also, you were able to reflect on my insecurities and showed me indirectly how to overcome them. Thank you so much! Cha Cha**,** I appreciated a lot that I could always knock on your door in Calslaan, when the scientific sky fell upon me. I remember your words 'Selene, you cannot include everything'. You were right. I know I may sometimes have driven you crazy, so I thank your patience and care ☺ Julian, vielen Dank für unter anderem dein indirektes ankitzeln meines Ehrgeizes über Lachyoga. Zudem möchte ich dir und Grace, Alex und Sarah danken mich beim brainstormen oder feinschleifen der These unterstützt zu haben. Hugo en Elske**,** bedankt voor jullie waardevolle suggesties over mijn these. Flo**,** danke für deine guten Tipps, den Überblick beim wissenschaftlichen Arbeiten zu behalten. Jaqueline, Hemo and Amit, in my opinion, we were a great Career Services Dream Team ☺ Thank you for supporting me with my study and making me believe in myself, too! Boris, ich erinnere mich noch genau, wie du meintest: Quantitative onderzoek ist easy, einfach ein paar Fragebögen benutzen, SPSS die Arbeit machen lassen und dat war's. Das war echt ein guter Witz…;) Danke trotzdem für deine aufbauenden Worte und deine Nachhilfe. Nils- Frederic, I felt honored that you read over my thesis and gave me some good suggestions. Thanks! Damian Gonzales Gonzales, gracias que crees en mi poder y para tu supporte mental. Estoy muy agradecida que 'we maintain our friendship beyond the limits of space and time.'Theresschen, danke dass du für mich da warst und mir in Momenten der Hilflosigkeit mit Tipps zum Schreibprozess geholfen hast. Bart, I did it! ☺ You inspired me and made me grow so much. I wish you all the best and hope that you are realizing your life visions. Claudia, danke, dass du mir wertvolle Tipps gegeben hast, mich zu entspannen. Dami, du hast mich indirekt inspiriert dieses Studium in erster Instanz erst zu beginnen.

Last but not least, I want to show my gratitude to my family. Jero und Katti, zwei meiner großen Geschwister, vielen Dank, dass ich mich immer bei euch ausweinen konnte, wenn etwas nicht gut lief ist mit der These. Oma**,** du bist mein größter Fan ☺ Du hast mir bei unseren nächtlichen Anrufen immer gesagt wie stolz du auf mich bist und das ich alles schaffen werde. Deine aufbauenden Worte und deine Liebe, haben mir viel Mut während der Masterarbeit gegeben. Danke! Papa, obwohl du diese Phase meines Lebens nicht mehr miterleben kannst, möchte ich dir trotzdem danken, für all die Dinge, die du mir beigebracht hast. Und nein, ich werde nicht vor der Kasse in der Pommes Bude landen, wenn ich mich nicht bilde ;), so wie du scherzhaft immer gesagt hast. Als letztens möchte ich einer der wichtigsten Menschen in meinem Leben danken. Mama, siempre estuviste a mi lado. En los estudios sufriste conmigo, cuando me desesperaba y celebraste conmigo cuando pasé a otra etapa. Para ti, este camino ha sido como una ‘Achterbahnfahrt’ , sobre todo porque no pudiste ayudarme en ocasiones como tú quisieras, pero aún así me ayudaste mucho con tus consejos y sobretodo tu amor. Estoy muy feliz de que seas mi madre. Gracias por todo. Un besito muy grande!

Table of Content

Introduction

Since the evolution of mankind laughter has played an important role (Gervais & Wilson, 2015). Our ancestors used laughter in order to express connectedness to their people, which was essential for survival. Laughter can be described as a physical reaction, which is characterized by rhythmical contractions of the diaphragm and other elements of respiratory processes. It also involves grimaces, vocalization and postural movements (Caruana, 2017). Laughter is universal and plays an essential part in human communication. It is said to be a social bonding mechanism (Kashdan, Yarbro, McKnight, & Nezlek, 2014). In general, laughter can be used in various emotional contexts (Szameitat, 2009) for example, one can shed tears whilst laughing, cry first and then laugh or vice versa. It can be expressed in different levels (ranging from gently smiling to a real laughter 'attack') and it is used for several purposes (e.g. to laugh at somebody, as a form of politeness or as form of showing sympathy to somebody). The focus of this current study will be on the positive side of laughter as described in the following.

Laughter as an underlying mechanism for well-being

There are several laughter mechanisms, other than humor stimuli, that may contribute to one's well-being. In general, through laughter endorphins, the so-called happy hormones, are released, which promote an overall sense of well-being (Bennett, 2008). Also, dopamine, a hormone that comes from the neurological reward system and leads to feelings of pleasure, is released when laughing (Colom, Alcover, Sanchez-Curto, & Zarate-Osuna, 2011).

Specifically, facial feedback and mirror neurons will be elaborated upon hereafter. Facial feedback means, that by *intentionall* manipulating facial movement, positive emotional states and positive cognitive experiences can be achieved (Strack, Martin, & Stepper, 1988). The origin of this theory comes from Darwin (1872), who claims that a person's emotional experience can be strengthened in the presence of eliciting emotional stimuli, for instance through a smile or a laugh. There are different ways to explain how people's facial expressions influence their emotional reactions, and no commonly accepted explanation exists yet. On the one hand it is suggested that facial feedback works due to self-perception mechanisms. Therefore, people who perceive themselves to be smiling conclude that they are probably happy (Laird, 1974). On the other hand, it is claimed that facial feedback works due to physiological mechanisms, meaning that moving the facial muscles itself is the reason why people become happy. This might be due to peripheral feedback or due to direct connection between the motor cortex and the hypothalamus (Ekman, Levenson, & Friesen, 1983).

With regard to effectiveness of facial feedback there is some existing contradictory literature. The famous study by Strack et al. (1988) showed these phenomena to be true, however, attempts to replicate the findings failed (Wagenmakers et al., 2016). In another study it was pointed out that the methodology of the replicated study was essentially different from the original study. In the replicated study by Wagenmakers et al (2016), participants were observed by using a video camera (Noah, Schul, & Mayo, 2018), whereas in the original study by Strack et al (1988) they were not filmed. According to Noah et al. (2018) this small methodological difference was the reason why the replication of the findings failed. This current study will therefore rely on the assumption of Noah et al. (2018), and agree that humans can use laughter to influence emotional experiences (Strack et al, 1988; Noah et al., 2018).

Mirror neurons are a neurological phenomenon which fire back both when a person performs an action and when a person observes the same action performed by someone else. For instance, a person who observes another person laughing, is more likely to laugh as well. Mirror neurons might explain the contagious effect of laughter (Provine, 2012) and, also, why laughter works best, when it is shared. According to research laughter occurs 30 times more often in the presence of others (Provine, 2001) and shared laughter is also linked to a global relationship of well-being (Kurtz & Algoe, 2017). To conclude, the mechanisms mentioned above show that laughter can be performed both individually (facial feedback) and with the help of others (mirror neurons).

Effects of laughter

Laughter has many positive effects. There is even a study of laughter called 'Gelotology', that investigates laughter and its effect on the body, from a psychological and physiological perspective. From a physiological perspective, laughter is effective to for instance (1) enhance the immune system (Martin, 2002), (2)elevates the threshold of pain (Dunbar et al., 2011), (3) improves respiration (Provine, 2017), (4) stimulates blood circulation (Bennett & Lengacher, 2008) and (5) decrease stress hormones (Bennett, Zeller, Rosenberg, & McCann, 2003).

From a psychological perspective, laughter (6) reduces not only negative emotions, i.e. depressive symptoms but also (7) enhances psychological well-being (Martin & Ford, 2018). Laughter also (8) strengthens one's self-efficacy (Beckman, Regier& Young, 2007; Greene, Morgan, Traywick, & Mingo, 2016), so a belief in a person's own ability, Additionally, (9) laughter elevates the quality of life (Fukuoka et al., 2016) and as mentioned before, (10) increases social bonding (Kashdan et al., 2014; Kurtz &Algoe, 2015; DeCaro& Brown, 2016). Concludingly, laughter has several positive physiological and psychological effects, which might

turn it into an interesting component for an intervention. Such an intervention could be Laughter Yoga, in which individuals voluntarily laugh.

Laughter Yoga- What is that?

The Laughter Yoga International University defines Laughter Yoga (LY) as a unique activity that combines simulated laughter with yogic breathing, the so-called pranayama (Kataria, 2011). The popularity of LY can be observed by the fact that originally, LY comes from India and was invented by the Indian physician Madan Kataria. Since its foundation in 1995, the so-called Laughter Yoga movement established some 6000 Laughter Clubs, in more than 60 countries worldwide. In LY the laughter is at first simulated and therefore independent of external factors, such as jokes or humor. This results in the benefit that the evoked laughter is less dependent on cognitive capacities or other individual differences (Kataria, 2011).

The simulation of laughter in LY can turn into genuine laughter (happens naturally, due to external stimuli without one's own free will) and may become self-sustaining and contagious (Mora-Ripoll, 2011; Bloemker, 2015; Lindzus, 2017). The social setting in LY may trigger this natural laughter process more easily. Additionally, LY is considered as a bodily exercise (Kataria, 2011; Lindzus, 2017) By putting one's attention to the bodily exercises and out of one's head, a person's laughter may become more natural (Bloemker, 2015). Moreover, LY aims to cultivate childlike playfulness (Kataria, 2011). As observed in daily life situations, children laugh for no reason, especially when they are playing. In fact, children laugh much more frequently than adults, namely some 350 times a day compared to adults who laugh on average 20 times a day (Kataria, 2011). Finally, LY has the advantage, that the duration of laughter can be actively manipulated. The longer a person laughs the more beneficial effects occur (Kataria, 2011).

Although, to the best author of this study, there is yet not a lot of scientific evidence, that simulated laughter is as effective (or even more effective) than genuine laughter, there are however, several studies that show the effectiveness of LY as such.

Effects of Laughter Yoga on mental well-being

The positive effects of LY are, amongst others, an improvement in mental well-being. According to the World Health Organization (WHO) mental health is "a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community" (World Health Organization, 2004d, p.12). Mental well-being entails both hedonic and eudaimonic traditions of wellbeing (e.g. Deci and Ryan 2008). Hedonism means predominantly, the pursuit of pleasure whereas eudaimonia includes more complex aspects, such as functioning

well in life, both psychologically (e.g. self-acceptance, environmental mastery, positive social relationships, and purpose in life) and socially (e.g. social acceptance and social integration) (Keyes, 2002).

There are not that many studies that focus on LY, but the existing ones show an increase of similar forms of mental well-being, such as positive mood and happiness (Elis, Ben-Moshe, & Teshuba, 2017) and an improvement of life-satisfaction (Shahidi, Mojtahed, Modabbernia, Mojtahed, Shafiabady, Delavar, & Honari, 2011). Moreover, a previous pilot study of DeCaro & Brown (2016) found that LY significantly enhances well-being in both elderly patients with Parkinson and in their caregivers. However, the questionnaire that has been used in the DeCaro et al. study (2016), was not based on academic research and therefore the results can be questioned. In addition, a pilot study by Elis et al. (2017) found that LY improves positive mood and happiness for adults in residential age care homes. Although this study used validated questionnaires, it did not include a control group and therefore the positive effects in both studies cannot be compared.

To summarize: although studies have suggested that there are positive effects of LY on mental well-being, each of those studies have serious methodological shortcomings. Therefore, this present study aims to improve on these shortcomings by using well-validated measurements, as well as a control group.

The relation between Laughter Yoga and self-compassion

In general, self-compassion means unconditional self-acceptance. It is also an important concept to use in moments of suffering, as it helps individuals to find inner strength and understanding towards oneself in difficult life situations (Neff & Lamb, 2009). Specifically, self-compassion entails three components: self- kindness (vs self-judgement), mindfulness (vs over identification) and common humanity (vs isolation) (Neff, 2003b). Despite the fact, that there is some scientific evidence that *yoga* helps building self-compassion and increases coping strategies (Crews, 2016) to the best knowledge of this author, to date no study has been conducted on the relation between *LY* and self-compassion. There is research suggesting that self-compassion might be an underlying working mechanism for mental well-being and its potential as a resilience resource (Trompetter, de Kleine, & Bohlmeijer, 2017). Also, there is no study to date that has investigated whether the relation between LY and mental well-being can be explained by self-compassion. Therefore, an explorative assumption is made here, namely that self-compassion might be an existing underlying mechanism of LY.

Firstly, using laughter in LY is argued here to be an act of self-kindness, because a person actively laughs with the intention to comfort oneself (in difficult situations). Secondly, mindfulness means acknowledging one's difficult thoughts and feelings and being able to embrace these with understanding and empathy. In LY there is the option to observe, similar to traditional meditation, upcoming thoughts and emotions from an inner distance, but has added laughter as an element on top of this. This can both have a mindful approach of a being in the present moment, as well as an additional positive stimulation, which helps coping with possible struggles (Lindzus, 2017). Thirdly, common humanity is the notion that everybody carries his own package of struggles/vulnerabilities and considers these imperfections as a part of being human, rather than something that just happens to an individual (me). As LY is mostly practiced in a group, a person can undergo shared laughter experiences and can connect to others, whilst going through an individual process (Bloemker, 2015). All in all, self-compassion may enable a person to keep an emotional distance of problems and consider these from another perspective.

Effects of Laughter Yoga on health promoting behavior

LY can contribute to gain sources of health (Bloemker, 2015). A theoretical framework for health promotion is the Salutogenesis model (Antonowsky, 1997; Bloemker, 2015). The Salutogenesis model seeks to explain why some people are able to maintain, and even improve, their health in particular (stressful) life situations. The emphasis is on the internal healing resources of individuals and their potential for active adaptation to new circumstances. The model involves two key concepts, namely the sense of coherence and the general resistance resources (i.e. social support, health awareness, cultural stability, etc.) (Blättner, 2007), and has parallels to self-efficacy (Posadzki, & Glass, 2009).

LY is in line with the Salutogenesis model (Bloemker, 2015). According to Bloemker (2015), the attention in LY lies on the individual resources and on the health promoting aspects, because LY promotes positive components rather than sick-making factors that have to be avoided. Moreover, LY improves levels of self-efficacy, which is an important element in the Salutogenesis model (Bloemker, 2015). This is also supported by an empirical pilot study by Greene et al., (2016) who found that LY significantly increased self-efficacy, when used in exercise for older adults in assisted living facilities (Greene et al., 2016). There it has been suggested that physical activity programs that elicit positive emotions, such as LY, may positively influence the participants' adherence. However, it remains unclear whether LY potentially can influence actual behavior too.

The current study

The primary goal of this present study is to examine whether LY is an effective positive psychological intervention that can be used to increase mental well-being. A positive psychological intervention (PPI) is defined as 'an activity that is primarily aimed at increasing positive feelings, positive behavior or positive cognition, as opposed to improving pathology or correcting negative thoughts or inappropriate behavioral patterns' (Sin & Lyubomirsky, 2009, page 469). In addition, there are several secondary goals to explore. One such goal is to explore how LY is experienced by the participants. A closer look will therefore be taken on the experiences with simulated laughter and how broad these can be applied in practice. Another secondary goal is to estimate whether LY affects the amount of self-compassion of a person, which is something that has not been investigated before. Self-compassion has also not been used to explain the relation between LY on mental well-being. That is why another goal of this current study is to fill this gap, and test whether the effects of LY on mental well-being is mediated by self-compassion. The final goal is to determine the effectiveness of LY on health promoting behavior. There is a limited amount of studies available on LY in relation to self-efficacy (to exercise), which is the psychological concept of influencing a certain exercise behavior. However, it has not been empirically tested whether LY can influence *actual* behavior. In addition, the author of this current study argues, that, in order to get a full picture of a person's health behavior, other factors, such as alcohol and smoking behavior, also need to be included. To summarize; this present study will investigate the following research questions:

1. How is Laughter Yoga experienced?
2. What is the effect of Laughter Yoga on positive mental health (primary outcome) and health promoting behavior, including alcohol and smoking (secondary outcome)?
3. Is the effect of Laughter Yoga on positive mental health mediated by self-compassion?

Methods

Design

A quasi-experimental pre-post design, with an intervention condition and a non-randomized waitlist-control group, has been used. The Laughter Yoga condition (LYC) is described in more detail later in this study. The waiting list control condition group (WLC) did not participate in the interventions. Both groups received similar questionnaires, with the exception that only the LYC received additionally evaluation questions about the intervention itself. Also, the questionnaires were distributed twice in the LYC (at baseline measurement (T0) and after two weeks (T1)).

Originally, a randomized control trial was aimed for in this current study, but, at the end, this was not possible due to organizational reasons and a lack of time. For instance, many of the recruited participants live far away (100 km or more) from the location where the intervention took place. In addition, there was a limited amount of time to recruit the participants (two weeks) and, consequently, not many participants living in the area could be found. Participants living further away needed to be assigned to the waitlist-control group. It is important to mention that there was a lot of interest, from all participants recruited, to join the LY intervention group. However, only those participants who had 'geographical advantages' were assigned to the LY intervention group. The Ethics Committee of the University of Twente approved this study in December 2018 (no. 180074). An informed consent form was digitally distributed to the control condition group, and for the LYC group this form was both distributed online as well as given in paper form. All participants agreed to participate in this present study.

Participants and Procedure

In December 2018 and January 2019, potential participants were recruited both in Germany and in The Netherlands. They were invited to participate in this study, either by personal invitation or by means of using flyers. The flyers contained background information about LY, inclusion criteria, a short procedural description of the study, information about the chance to win 20 euros and a contact address of the researcher. Inclusion criteria were (1) a participant needed to be 18 years or older, (2) have an internet connection and a valid e-mail address and, (3) was willing to spend time to contribute to this study (three hours for experimental group (LYC) and 40 minutes for WLC. Exclusion criteria were: not being physically able to laugh and not being able to understand the German or English language.

Of the 54 eligible participants, 52 completed the baseline questionnaire and 48 completed all the questionnaires (see flowchart Fig.1). A personal reference number was given to all participants to guarantee anonymity and to enable the researcher to compare 'within group' differences (pre-post). The data collection took place between January and February 2019. In order to schedule the scientific meetings, the software Doodle was used. The questionnaires were distributed via the software Qualtrics. To reinforce adherence, participants in the WLC and LYC were reminded by email to either complete the questionnaires and/or join the LYI on the agreed upon dates. Regular reminders about the upcoming LYI were distributed via email, mostly on the morning of the intervention itself. The reminders contained persuasive expressions, in order to encourage adherence, such as "You have completed the first questionnaire: Very good, very good, yeah!" or "Looking forward for the next session".

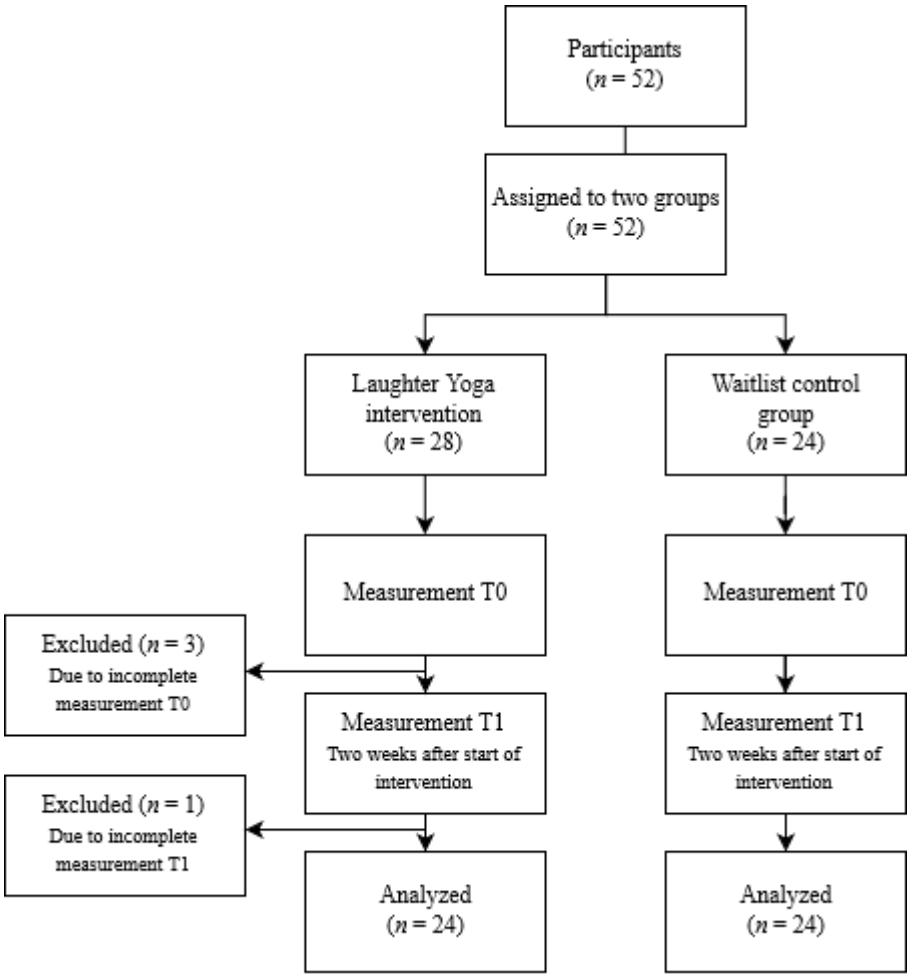

Figure 1. Flow-chart of participants in the Laughter Yoga Study

The Intervention

The LYC covered in total four sessions, twice per week, each lasting 30 minutes. A longer intervention trial (for instance eight sessions) was not possible due to time limitations of this current study. Nevertheless, the time interval, twice a week, was in line with suggestions from previous research on yoga (Snaith, Schultz, Proeve, & Rasmussen, 2018). In general, the sessions were independent from each other. Simulated laughter and breathing exercises were integrated as well as playful elements. The LYC was build up in three parts: Warm-up, laughter exercises and laughter meditation.

Firstly, the warm-up was 5- minutes long, consisting of group- games, rhythmic exercises and some coordination exercises. Secondly, the main part were different simulated laughter exercises and movements, lasting 20 minutes. A standard element of the laughter exercises were "the soundless laughter", "the electroshock" and the exercise "we are the happiest people in the world". In-between the laughter exercises and movements, the LY-clapping mantra "Ho Ho Ha Ha Ha" or the mantra "Very good, very good yeah!" was done as a connection element. In addition to that, a group deep-breathing break after every third laughter exercise was practiced, which was repeated three times in a row in example together raising the arms, while breathing in and letting them down while breathing out.

Thirdly, in the 5- minutes laughter meditation, participants were invited to experiment with their own laughter. It was instructed to lie or sit down in a circle with the eyes closed and shake of a laughter. This free-laughter exercise aimed to dedicate the attention to one's own laughter and to observe all emotions and thoughts in the present moment. The laughter yoga intervention was closed by a mantra ("The river is flowing"), which was song by the LY instructor. At the fourth and last LY session, a feedback round was included, where participants briefly could express their opinion, perception and experience of the LY. The LY sessions were given by a certified Laughter Yoga instructor. It needs to be stressed out here, that the LY sessions were given by the researcher of this study herself.

Materials

During the baseline measurement T0, the participants were provided with several questions about their demographic information, including age, nationality, education, work, previous experience with LY and yoga in general.

The primary outcome was *mental well-being*, which was measured with the 14 item Mental health Continuum Short Form (MHC-SF) (Lamers, Westerhof, Bohlmeijer, ten Klooster,

& Keyes, 2011). The form contains three dimensions of mental well-being: emotional well-being (3 items about happiness, positive affect, life satisfaction), psychological well-being (6 items about self-acceptance, environmental mastery, positive relations, personal growth, autonomy and purpose in life), and social well-being (5 items about social contribution, social integration, social actualization, social acceptance and social coherence). Each item could be answered on a scale from 0 (never) to 5 (almost always). In this study, the internal consistency of the positive relationships scale was calculated using Cronbach's alpha. In this study, the internal consistency of the WBI was calculated using Cronbach's alpha. During T0 and T1, the internal consistency of the total sample was good, T0, $\alpha = .88$ and T1 $\alpha = .87$. The higher the scores on the MHC-SF, the more participants said to be/feel more flourishing. The researcher of this study translated the MHC-SF in German, as there is no German version of that psychometric measurement tool yet. The translation was controlled by another mother tongue German speaker, who retranslated it into English.

There were several secondary outcomes, namely (1) self-compassion, (2) health promoting behavior (including alcohol and smoking) (3) motivation and (4) mood of participants in the LYC. First, s*elf-compassion* was assessed with the 26 items Self-Compassion scale (SCS) by Neff (2003b). It measures, on a 5-point Likert scale, six components of self-compassion, namely Self-Kindness (5 items), Self-Judgement (5 items), Common Humanity (4 items), Isolation (4 items), Mindfulness (4 items) and Over-Identification (4 items). Here, the SCS was used as a whole, as well as its positive and negative dimensions. The positive dimension is named here as the positive self-compassion subscale, including the items self-kindness, mindfulness and common humanity. The negative dimensions refer to the negative subscale of self-compassion, including self-judgement, over-identification and isolation. It is important to mention here that the present study reverse-scored questions regarding Self-Judgement, Isolation and Over-Identification, when total self-compassion scores were calculated. In other words a high score of , participants on the SCS indicates that they have more self-compassion. In this study, the internal consistency of the WBI was calculated using Cronbach's alpha. During T0 and T1, the internal consistency of the total sample was good, T0, $\alpha = .84$ and T1 $\alpha = .85$. This study not only used the original SCS, but also the German SCS-D, which also shows a good validity and reliability (Hupfeld & Ruffieux, 2011).

Secondly, *health promoting behavior* was assessed by using the 12- items Wellness Behaviors Inventory (WBI) from Sirios (2001). It measures how often health promoting behaviors (for example, exercising, healthy eating etc.) are performed. Health promoting behavior can be categorized into preventive health behaviors and into risk- taking behaviors. The

WBI items are scored on a 5-point scale, ranging from 1 (less than once a week) to 5 (every day of the week). The current study reverse-scored two items (3 and 10) before calculating the mean. In this study, the internal consistency of the WBI was calculated using Cronbach's alpha. During T0 and T1, the internal consistency of the total sample was good, T0, $\alpha = .73$ and T1 $\alpha = .77$. As there is currently not a formal WBI in German, the researcher of this study (native German speaker) translated the items herself. This German translation was subsequently retranslated into English by another person. There is a need for a more profound analysis pertaining to the validity and reliability of the WBI as is currently translated into German.

However, since the WBI does not contain of items about alcohol and smoking behavior additional questions were added. *Alcohol behavior* was assessed by using the Graduated-Frequency measure by (Clark and Midanik 1982; Midanik 1994). The GF Measure asks respondents to report the frequency of alcohol drinking in accordance with different levels of drinking (e.g., 1–2 drinks or 3–4 drinks etc.; the highest level is most ever consumed) for combined beverage types (Webb, Redman, Gibberd, & Sanson-Fisher, 1991). In this study, the internal consistency of the GF was calculated using Cronbach's alpha. During T0 and T1, the internal consistency of the total sample was good, T0, $\alpha = .71$ and T1 $\alpha = .74$. *Smoking behavior* was assessed by querying two items, namely (1) Do you smoke? and (2) if yes how many cigarettes (e-cigarettes, shisha or marihuana) do you smoke each day?

Thirdly, the *motivation* of the participants in the LYC regarding the, to be started, LY session was assessed by simply asking: "How motivated are you today for the LYI?", as measured on a scale from 1-10, whereby 10 was the highest and 1 was the lowest level of motivation. This was asked and answered before each LY session, and written down on a piece of paper,

Fourthly, *mood* was assessed with one item: "How do you feel right now?", as expressed on a scale from 1-10, whereby 10 was the highest level. It was measured right before and immediately after each LY session, and was also written down on a piece of paper.

Evaluation/ User experience

The *evaluation and user experience* of the participants in the LYC was assessed by using both quantitative and qualitative data. The quantitative data was obtained and assessed by asking participants to indicate their level of satisfaction on a scale from 1-10 (1= extremely dissatisfied and 10= extremely satisfied) to determine how satisfied/dissatisfied they were on average with a) the Laughter Yoga instructor, b) the Laughter Yoga sessions and c) the duration of the session, at the end of the LYI's. Additionally, the *psychological or physiological effects* were assessed using a multiple-choice option, with nine displayed items in the form of adjectives, where participants

could choose from (more answers were possible). Immediately after the first LY session these questions were digitally collected.

Qualitative data was gathered by means of a 20 minutes semi-structured interview. Due to a lack of literature on LY, it was decided to use these additional interviews, in order to get more insights into the overall picture of LY. Two participants (one male, 24 years old and one female, 54 years old, both from Germany), were selected based on a convenience sampling a few days after measurement t1. These two participants were selected because, in the view of the author of this current study, they each had slightly different conceptions on LY, allowing for a variety of input, i.e. not only positive statements but also critical ones. Based on the small sample size no general conclusions can be drawn, however. Inspired by a previous qualitative study on yoga, by van Uden-Kraan & colleagues (2013), the questions in this particular interview addressed three topics: motivation to participate in the LYC, the experience during the LYC, and the psychological and physiological outcomes of the LYC An illustration of the questions is shown in Table 1.

Table 1.

Key questions per topics used during the personal interview (N = 2)

Topics	Key questions
Motivation to participate in LY	– What was your motivation to participate in this study?
Experience practicing LY	– Can you describe your experience during Laughter Yoga? – How was it for you to laugh on purpose?
Outcomes from participation in LY	– What psychological and/or physiological changes did you notice?

Statistical analyses

This study used the statistical software program SPSS version 23.0 (IBM, Chicago, Ill., USA). The cutoff score for statistical significance was set at a p-value of $< .05$. Firstly, a Shapiro-Wilk test was done for all pre- and post-measures of mental health, self-compassion and health promoting behavior, in order to check normal distribution. Positively, in none of the cases, the assumption of normality was violated. In addition to that, demographical statistics at baseline of participants characteristics were made, as well as Chi- square tests and t-tests for independent samples in order to measure, whether there are differences between the two conditions (LYC and WLC) at baseline. A conservative Bonferroni correction of the p values (0.5/5=0.01) was applied

as well, as a consequence the p values was significant, when p= 0.01. Then, bivariate Pearson correlation were conducted for all outcome measures at baseline. With regard to the strengh of the correlation it can be stated, that correlation from 0 to 0.3 are weak, 0.3 to 0.5 as moderate and a correlation above 0.5 can be defined as a strong correlation (Cohen, 1988).

Moreover, repeated measures ANOVA with condition as between factor were used in order to test whether there was an impact of the LYI on primary and secondary outcomes 2 (group) by 2 (time). Due to the fact, that there were significant baseline differences between the groups on age ($p<0.05$) and experience yoga ($p=0.14$), these variables were put as control variables, using repeated measures ANCOVA. The experience yoga was categorized in little experience (no experience or practiced only one time), middle experienced (practice more than one time a year, more than one time a month) and much experience (more than one time a week or practice every day). The effect sizes of the interaction effects were calculated by hand. As suggested by Cohen the effect size is categorized into small ($d=0.2$), medium ($d=0.5$) and large ($d=0.8$). Additionally, it was tested for the intervention group only, whether the motivation of the participants to join LY increased over time and if there was a change from pre-post in the variable mood by using repeated measures ANOVA, as well. Drop-outs were considered as incomplete data, and therefore at all measure moments no analysis was done.

Finally, mediation model analysis was conducted using SPSS macro PROCESS by Andrew Hayes (2009). The aim of this analysis was to measure if any effects of the intervention LY on mental well-being, was mediated by self-compassion. In this current analysis, X is the condition (Laughter Yoga coded as 1 and the wait-list control group coded as 0), Y is the t1-t0 change in the outcome measure of mental well-being and M is the t1-t0 mediator measure of self-compassion. Importantly to mention that, it was controlled for the variables age and experience Yoga as covariates. Unstandardized regression coefficients were conducted for each path in the mediation model. Path a shows the effect of X on M, path b shows the effect of M on Y and path c shows the total effect of X on Y. Path c' means, the direct effect of X on Y, excluding the effect of M. The indirect effect of X on Y through M is calculated as the product of a and b (ab). Based on 1000 bootstrapping samples, estimation took place of the bias corrected 95% (BC) confidence intervals (CI). As stated by Preacher & Hayes (2008) the mediation is significant when a zero is not included in the Confidence interval. There is a significant mediation when this applies to the test or indirect effect or x on Y. A full mediation is occurring when the direct effect, X on Y (c '), does include a zero. Finally, to test whether self-compassion predicts well-being over time

bivariate Pearson correlations were applied, using the variable self-compassion at T0 and the variable well-being at T1.

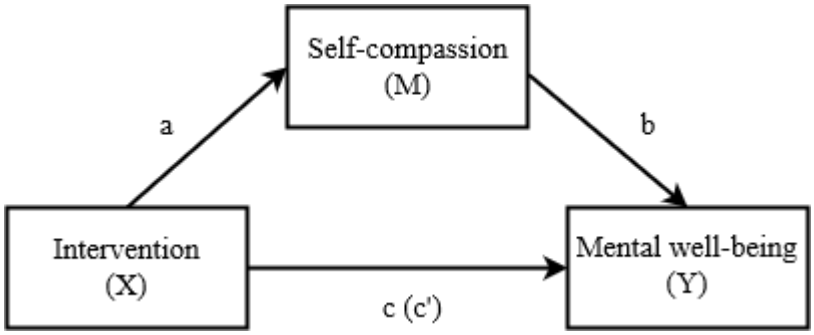

Figure 1. Proposed mediation model.

Note: The covariates age and experience yoga were included in both variables self-compassion (M) and Mental well-being (Y)

Results

Description of the study groups

As illustrated in Table 3, the mean age of the participants was 35 years (Minimum age= 19 and Maximum age= 77), predominantly female (*n*=30) and having both European (*n*=41) and Non-European (*n*=7) Nationality. Most of the participants got more than the secondary education (*n*=40), indicating that the participants of this sample mostly were higher educated. The state of employment of most of them was or being employed (*n*=20) or student (*n*= 18). No significant differences existed with regard to Nationalities, education, employment, experience in Yoga and experience in LY. However, there was a significant difference in age. Hence, participants in the LYC were significantly older than in the WLC.

Table 3.

Demographic information of both conditions with mean and standard deviations and difference at baseline measurement (N = 48)

	Laughter Yoga Condition (LYC)	Wait-list Control Condition (WLC)	Total	Differences at Baseline
Age, *M(SD)*	39 (17.0)	30 (10.0)	35 (14.5)	0.05[a]*
Gender *n*				0.16[b]
Female	18	12	30	
Male	7	11	18	
Education, *n*(%)				0.14[b]
Vocational education	2	0	2	
Secondary education	4	0	4	
Higher secondary education	9	8	17	
Bachelor degree	3	8	11	
Master degree	6	6	12	
-Other	1	1	2	
Nationality, *n*(%)				0.14[b]
German	20	12	32	
Dutch	2	2	4	
Spanish	1	4	5	
Other	2	5	7	
Employment, *n*(%)				0.64[b]
Unemployed looking for work	1	1	2	
Student	10	8	18	
Trainee	1	0	1	
Employed	8	12	20	
Self-employed	2	1	3	
Experience with LY, *n*(%)**				0.49[a]
Several times a year	1	6	1	
Only one time	4	0	10	
No	20	17	37	
Experience with Yoga, *n*(%)**				0.14[a]
Every day	1	0	1	
Several times a week	3	0	3	
Several times a month	7	2	9	
Several times a year	3	4	7	
Only one time	5	5	10	
None	6	12	18	

Note: Group differences per category calculated using the following tests: a) Independent t-test b) Pearson Chi-Square; Significance *p> 0.05; **experience with LY and Yoga categorized in little experience (no experience or practiced only one time), middle experienced (practice more than one time a year, more than one time a month) and much experience (more than one time a week or practice every day).

Adherence drop-outs, evaluation and user experience

There were four participants who dropped out, due to reasons such as a lack of time or technical- related problems. Moreover, the data from participants who did not complete all the measurements or only joined once or twice the intervention, were excluded from further analysis. The evaluation and user experience were summarized in Tables 4 and 5. Please note, that these

tables do not depict the satisfaction of among others the LYI. Those results are shown in text form. Results from the perceived psychological and physiological effects of LY show (see table 6) that most respondents used positive adjectives, such as Physically (n=17) and mentally relaxed (n=17), satisfied (n=17) or happy (n=13). However, for a substantial part the LY had also been tiring (n=10) or confused (n=5). One respondent indicated that the LY had left her sad.

Table 4.

Overview psychological and physiological impact of LY on participants (N = 24)

Please indicate which adjectives described best how the Laughter Yoga has made you feel? (More than one answer possible)		
Categories	Adjectives	N*
Positive	Physically relaxed	18
	Satisfied	17
	Mentally relaxed	17
	Positive	13
	Happy	13
Neutral	Tired	10
Negative	Confused	5
	Sad	1

Note: * Numbers refer to the amount that given adjective was selected. Consequently, numbers do not add up to 24, since more than one answer was possible.

Secondly, as shown in table 5, participants evaluated the LYI very positively on aspects such as the intervention itself (Minimum = 6, Maximum = 10), the duration (Minimum=7, Maximum=10) and the instructor (Minimum = 7, Maximum = 10). In addition to that, as shown in table 6, at the end of each intervention participants scored significantly higher on the question about their mood "How do you feel on a scale from 1-10" [M = 8.1, SD = 0.8), than at the beginning of each intervention [M = 6.8, SD = 0.7, t (24) = 12.43, p< 0.01, η_{p2}= 0.81]. However, the motivation to join the LYI did not increase over time [F (3,22) = 2.24, Wilk's Λ = .77, p = .11].

Table 5.

Evaluation on average of the LY-intervention, -duration and - instructor

From a scale between 1-10 how would you rate the Laughter Yoga…	M	SD
Intervention	8.60	1.30
Duration	8.80	1.20
Instructor	8.90	1.00

Note: *M* = Mean; *SD* = Standard Deviation

Table 6.

Mean and standard deviation of pre-post changes in mood per LY session and the motivation before each session

Session	Time	Mood		Motivation	
		M	SD	M	SD
First session (*n* = 24)	Pre	7.04	0.93	8.10	1.24
	Post	8.02	0.91		
Second session (*n* = 24)	Pre	7.00	0.84	8.00	1.33
	Post	8.20	0.90		
Third session (*n* = 24)	Pre	6.80	1.04	7.40	1.29
	Post	8.00	1.11		
Fourth session (*n* = 24)	Pre	6.70	1.20	7.40	1.50
	Post	8.60	0.91		

Interviews

The qualitative data was gathered by means of using two interviews. Please note that, in order to guarantee the anonymity of the participants, they will be called interviewee 1 and interviewee 2.

Motivation to participate in Laughter Yoga

The two interviewees each named different motivations to join this current study. Those can be categorized into extrinsic and intrinsic motivations. For example, both interviewees shared the extrinsic motivation to help the author of this current study with her research. However, their intrinsic motivation differed. Interviewee 1 was very open towards LY, because she has an affinity to laugh, no matter what other people think of that and said that people should laugh more often in general. In contrast, interviewee 2 was more skeptical towards LY, because he did not feel that comfortable with simulating laughter. However, this participant considered this to be a personal learning effect and he was subsequently motivated to challenge himself to overcome

personal boundaries. He said: *'I read that when you do something you are afraid of then the learning effect is bigger than ever, because it is something new. (..) I wanted to overcome my boundaries.' (Interviewee 2).* Therefore, it may be concluded that the motivation to do LY differs amongst individuals.

Experience of Laughter Yoga

The experience of LY can be divided into two categories, namely positive and negative experiences. In general, the experience was perceived differently by the interviewees but this perception also (partly) changed during the intervention. With regard to the positive experiences, interviewee 1 liked the interventions a lot and didn't have any (negative) remarks. She said: *'It was a lot of fun.'* Interviewee 2, named, next to positive experiences, also some negative ones: he perceived LY as being scary at the beginning of the intervention, as he did not know how awkward the simulation of laughter can be and he was not sure how he might cope with such awkwardness. In addition, Interviewee 2 stated that '*the (loud) laughter of others was intimidating'*. This might be because hearing others laughing loud(er) than oneself, might make a person laughing harder as well, even if he/she feels that this is against one's natural laughter. Paradoxically he also stated that *'the authentical laughter of others'* made him enjoy the LY session. Looking back on all the sessions, he said that *'it was a nice community feeling and the general acceptance of what you do, how you laugh was very cool (…)'It was an inspiration to see how others came out of themselves.'* This seemingly reflects the experience development of individuals during the sessions; awkward and apprehensive at first, but more confident later on. One might draw from this that there are apparently different experiences with LY, both positive and negative, which not only differ between people but also within-people.

Effects of Laughter Yoga

Some positive effects of LY were mentioned by the interviewees. For instance, that one gets more balanced and that negative thoughts and feelings disappear for a while. Interviewee 1 said: *'I could switch-off my mind for a moment and forget everything around me'.* According to the interviewees LY also led to more relaxation. Interviewee 2 mentioned: '*I felt a bit of a tingle, I don't know, a bit of a trance maybe.'.* He also pointed out that he always felt better after LY, better than before a session. The reported positive effects of LY are thus both of a psychological and of a physiological nature.

Correlations between mental well-being, self-compassion and health promoting behavior

As illustrated in Table 7, the correlation at baseline between mental well-being and its subscales of the MHC-SF, self-compassion and its subscales and health promoting behavior,

including alcohol and smoke behavior are shown. Self-compassion, both the positive and the negative dimensions, was significantly correlated to mental well-being. The positive dimension of self-compassion was stronger associated to mental health (r=.48) than the negative dimension (r= .30) was. Most of the outcome variables of health promoting behavior did not significantly correlate with mental well-being and/ or self-compassion. Among those, only alcohol behavior correlated with mental well-being, its subscales psychological and social well-being, as well as smoking behavior.

Table 7.

Bivariate Pearson correlations at baseline (N = 52) for all outcome measures and its subscales (mental well-being, self-compassion and health promoting behavior, including alcohol and smoking behavior)

		1.	2.	3.	4.	5.	6.	7.	8.	9.
1. MHC-SF	Mental well-being	1								
2. MHC-SF EMO	Emotional well-being subscale	0.76**	1							
3.MHC-SF SOC	Social well-being subscale	0.88**	0.50**	1						
4.MHC-SF PSY	Psychological well-being subscale	0.89**	0.76**	0.66**	1					
5. SCS	Self-compassion Scale	0.41**	0.30*	0.32*	0.42**	1				
6. SCS POS	Positive self-compassion subscale	0.48**	0.34*	0.44**	0.44**	0.92**	1			
7. SCS NEG	Negative self-compassion subscale	0.30*	0.23	0.19	0.35*	0.94**	0.73**	1		
8.WBI	Health promoting behavior	0.12	-0.02	0.13	0.15	0.10	0.01	0.17	1	
9.GF	Graduated- Frequency measure Alcohol behavior	0.36*	0.23	0.33*	0.33*	0.03	0.01	-0.02	0.09	1
10. One item	Smoke behavior	-0.17	-0.01	-0.23	-0.18	-0.23	-0.21	-0.21	-0.18	-0.48*

Note: *p<0.05; **p<0.01

Interaction effects

As shown in Table 8, no baseline differences were found between the LYC and the WLC group on any of the outcome variables, using the independent t-tests. Repeated measures ANCOVA revealed that there were no significant time x group interaction effects of LY on the primary outcome, mental well-being (p=0.27), compared to the control group. There were significant time x group interaction effects of LY on the emotional well-being subscale (p<0.01). Thus, only on this dimension of mental well-being, a positive outcome was found. Importantly, the control group makes a drop in emotional well-being at t1 measurement, which consequences will be discussed later on.

There were no significant effects for the secondary outcome self-compassion: With the inclusion of the covariates no significant interaction effects on self-compassion and the negative self-compassion subscale were found (p=0.06), compared to the control group. Interestingly, the negative subscale of self-compassion is more towards a significant result that the positive subscale of self-compassion. In other words, participants that are uncompassionate (negative subscale) get more compassionate through LY. In contrast, participants that are already compassionate (positive subscale) do not get even more compassionate through LY. Aditioanly, a positive correlation between self-compassion (t0) and mental well-being (t1) (r=0.49, N=48, p< 0.01) could be reported.

No significant interaction effects were found on the outcome variables of health promoting-, alcohol-and smoke behavior before and after controlling for age and experience in yoga. This result indicates, that the level of health promoting-, alcohol- and smoke behavior did not improve in the LYI compared to the control group. Finally, Cohen's d effect sizes were small to medium, especially for emotional well-being, being the highest (medium) effect size was shown, between T0 and T1(d=-0.6, 95% CI= -1.17; -0.03).

Table 8.

Means and standard deviations for all outcome measures, baseline differences and results of the repeated measures analysis of variance and Cohen's d for between group effect sizes (LY condition versus wait-list control condition)

	Laughter Yoga Condition (LYC)		Wait-list Control Condition (WLC)		Baseline differences (b)	Interaction (b)		Effect size t0-t1
	Pre *M (SD)*	Post *M (SD)*	Pre *M (SD)*	Post *M (SD)*	*p*	F	*p*	*d* (95% CI)
Mental well-being	3.9 (0.9)	4.2 (0.9)	4.1 (0.5)	4.2 (0.7)	0.49	1.26	0.27	-0.23 (-0.53; 0.16)
Emotional well-being subscale	4.2 (1.1)	4.6 (1.1)	4.8 (0.9)	4.5 (0.9)	0.66	11.83	<0.01*	-0.6 (-1.17; -0.03)
Social well-being subscale	3.5 (1.2)	3.7 (1.1)	3.4 (0.8)	3.7 (0.9)	0.79	0.14	0.87	0.08 (-0.47; 0.63)
Psychological well-being subscale	4.3 (0.9)	4.4 (1.1)	4.4 (0.5)	4.4 (0.6)	0.50	0.61	0.37	-0.18 (-0.73; 0.37)
Self-compassion Scale	3.2 (0.7)	3.4 (0.6)	3.3 (0.7)	3.2 (0.7)	0.52	4.75	0.06	-0.35 (-0.9; 0.2)
Positive self-compassion subscale	3.2 (0.7)	3.4 (0.7)	3.3 (0.7)	3.3 (0.8)	0.65	2.16	0.19	-0.26 (-0.81; 0.29)
Negative self-compassion subscale	3.2 (0.8)	3.3 (0.7)	3.3 (0.9)	3.2 (0.8)	0.48	4.63	0.06	-0.37 (-0.92; 0.18)
Health promoting behavior	3.6 (0.4)	3.7 (0.5)	3.4 (0.5)	3.4 (0.5)	0.09	1.00	0.87	-0.15 (-0.7; 0.4)
Alcohol behavior	1.48 (2.18)	1.5 (2.3)	1.1 (2.0)	1.2 (1.8)	0.83	0.01	0.57	0.01 (- 0.54; 0.56)
Smoke behavior	2.56 (0.65)	2.5 (0.7)	2.7 (0.6)	2.8 (0.5)	0.97	2.00	0.45	0.13 (-0.42; 0.68)

Note: t-test for (a) differences between baseline and (b) interaction effect (time x group), * indicates a significant effect

Mediation

According to Preacher & Hayes (2004), the necessary conditions for a mediation are that both the independent variable (X) and the mediator (M) need to be bivariate predictors of the dependent variable (Y). In fact, in this current study, the two necessary condition for a mediation were not fully met. In other words, only LY (X) but not self-compassion (M) was a bivariate predictor of the emotional well-being subscale (Y). As a consequence, further mediation analyses were not performed.

Discussion

The aim of this study was to investigate in Laughter Yoga (LY), as well as to examine its effects on mental well-being, self-compassion and health promoting behavior. Therefore, the following research questions were addressed: 1) What is the effect of Laughter Yoga on mental well-being (primary outcome), self-compassion and health promoting behavior (secondary outcome)? 2) Is the effect of Laughter Yoga on mental well-being mediated by self-compassion? 3) How is Laughter Yoga experienced? The results of these research questions will be discussed hereafter.

Mental well-being and Laughter Yoga

The primary outcome dealt with the concept of mental well-being. Mental well-being did not significantly improve in the LY group, compared to the control group. However, one of the subscales of mental well-being, namely emotional well-being, was significantly enhanced in the LY group, as compared to the control group, having a medium effect size (*d*=.60.). However, it appears that the size of this effect is partly due to a drop in the emotional well-being subscale of the control group. This might point to an unknown factor, outside of the LY intervention, which needs to be investigated in future research.

The fact that emotional wellbeing was improved by LY is not surprising. Previous research already indicated that the laughter helps people to develop an affinity towards positive emotions, and the expression thereof, which in turn also has a positive influence on their affect (Junkins, 1999). The underlying mechanisms of laughter may contribute to that positive effect (Bennett, 2008; Strack et al, 1988; Noah et al., 2018; Provine, 2012).

Another finding of this study was that LY did not significantly improve social and psychological well-being, compared to the control group. A possible explanation for these findings may lie in the way how the different subscales of well-being relate to life. While social

and psychological well-being can be considered eudemonic in nature, thus striving for a good life and personal development, emotional well-being is more associated with hedonism the pursuit of pleasure (Seligman et al., 2000). In the context of this study, LY may be more successful in creating pleasurable moments and increasing positive emotions, rather than focusing on the more eudemonic aspects of life, such as self-actualization or autonomy.

To conclude: LY may appear to be a positive psychological intervention that may improves hedonic well-being in a mentally healthy population. More research is needed on the long-term effects of LY on emotional well-being, using longer term follow-ups.

Self-Compassion and Laughter Yoga

This was the first study on LY and its effect on self-compassion (secondary outcome). Self-compassion means the ability to be kind and non-judgmental to oneself especially when confronted with feelings or experiences of inadequacy, failure or suffering (Neff, 2003b). LY did not significantly enhance the level of self-compassion in the LY group, compared to the control group ($p=0.06$), as it had a small effect size ($d= -.35$). However, self-compassion and its subscales improved slightly, but consistently, in the LY group.

Although there were no significant findings here, a qualitative study on yoga by Crew (2016) claimed that yoga may enhance levels of self-compassion for female survivors of sexual violence. Therefore, self-compassion may be still a concept that potentially is important in LY, too. A possible explanation why in this study self-compassion was not enhanced by LY, may be because the context of the sessions was not specifically related to a particular type of suffering, where self-compassion could help with, whereas in Crews (2016) suffering was addressed.

Another explanation may be that here, LY was done with mentally healthy individuals, whereas previous mostly used yoga in a clinical population (Crew, 2016; Snaith, Schultz, Proeve, & Rasmussen, 2018). Also, LY may not enhance levels of self-compassion for individuals who are already high on self-compassion. It may be more suitable for individuals who are not compassionate towards themselves. Then, however, specific training in self-compassion, is needed during LY to make the intervention more useful for elevating levels of self-compassion in these individuals.

To conclude; no scientifically underpinned interpretations of these current findings can be made yet, as the lack of research data on LY on the topic of self-compassion is rather great. Therefore, more research, especially studies of qualitative nature, needs to be conducted to obtain a deeper understanding of the underlying mechanisms of self-compassion in LY. Finally, in order

to teach self-compassion during LY, this intervention may raise more awareness on this concept and address specific needs/topics of suffering of the target group.

Self-compassion and underlying working mechanism of Laughter Yoga?

With regard to this other secondary outcome, do the findings of this study suggest, that self-compassion is not an underlying working mechanism between the relation of LY on mental well-being. However, two significant correlations can be found at baseline between self-compassion, namely self-compassion total and its positive self-compassion subscale and mental well-being. The positive correlations between self-compassion and mental well-being were also expected on the basis of previous research (Shin & Lim, 2018). Here, additional analysis showed that there was a positive relation between self-compassion at baseline and mental well-being after the four interventions described, hinting in favor of the assumption that self-compassion might potentially be causally related to mental well-being.

A possible explanation, as to why no mediation effect was found, might be that the intervention frequency was too short. Also, the design of this current study was not aimed at concluding this specific causal assumption empirically. A future experimental study may reveal more information and should also further determine the longitudinal effects of self-compassion on mental well-being (Shim et al. 2018).

Health promoting behavior and Laughter Yoga

Another secondary outcome dealt with LY and health promoting behavior. Here, LY did not significantly improve the health promoting behavior (including smoking and alcohol consumption) of participants in the LY group, compared to the control group. Also, no correlations between health promoting behaviors (including alcohol and smoking) and self-compassion could be found, and a correlation between health promoting behavior (including alcohol and smoking) and emotional well-being could not be found either. The finding that emotional well-being was not correlated with health promoting behavior contradicts previous research, in which a lot of evidence was found that positive affect is associated with the practice of health promoting behaviors, both cross-sectionally and longitudinally (e.g. Conner, 2013). In line with the Salutogenesis model of Antonovsky (1997) the focus of LY is on the individual resources and on the health promoting aspects (Bloemker, 2015).

However, a possible explanation, as to why there were no significant improvements on health promoting behavior in this current study, might be because in this study it was measured whether LY *directly* influences health promoting behavior. However, according to the theory of planned behavior (TPB), for this to happen, other cognitions, with respect to these behaviors of a

person, need to be influenced first (Ajzen, 2006). It might therefore be possible that changes in certain cognitions have occurred through LY but, due to a relatively short follow-up period, these may not have been resulted into (health promoting) behavior yet. Therefore, future studies should also investigate in cognition influencing behavior, as mentioned in the previous study of Greene et al. (2016). There, for instance, an *indirect effect* of LY on self-efficacy (Greene et al., 2016) (to exercise) was found.

To conclude, the potential of LY might be more in enhancing one's self-efficacy (Bloemker, 2015), through positive emotions, rather than actual behavior. A practical recommendation would be to combine LY with other health interventions, as to enhance health promoting behavior. Additionally, the LY intervention itself could be improved in such a way, that, during the session more awareness is raised on health promoting behaviors which indirectly stimulates participants to engage in these more.

The Laughter Yoga experience

LY is a positive psychological intervention and therefore its main aim is it to effectively elicit positive emotions, behavior and cognitions (Sin et al., 2011). In this study it was found, that the majority of the participants were, overall, very satisfied with LY and that they felt significantly better after each session. Also, most of the participants select the positive adjectives from the ones available, such as 'physically and psychologically relaxed' 'happy' or 'positive'. The interviews revealed that LY '*was a lot of fun',* as well, and that it was a '*nice community feeling'*. Nevertheless, a small number of participants select adjectives such as 'confusing' or 'sad'. During the interviews, one participant mentioned as well that LY was at the beginning '*quite challenging'* and '*intimidating'*.

Both the positive and negative experiences in this study are in line with previous studies, arguing that the negative perceived feelings diminish over time especially (Bloemker, 2015; Lindzus, 2017). A possible reason for this may be that LY entails many elements that make oneself comfortable (i.e. mindfulness and social support component). Also, participants in this current study were, in general, positive towards mind-body interventions because of their interest in yoga. Finally, a possible general suggestion is that LY may act both as a trigger of negative feelings (intimidation, not being able to laugh, embarrassment, etc.) and as a coping mechanism (e.g. learning how to deal with them by laughing).

In all, the majority of participants was very satisfied about LY, which is a strong indication that LY may be suitable to be used as a positive psychological intervention. Still,

future research should investigate the few mentioned negative experiences, such as the challenges to practice LY for novice persons, by conducting interviews or by expanding the overview of (negative) adjectives with more adjectives such as scary, awkward, embarrassing and so forth. It is advised that LY instructors adjust the LY sessions to the LY experiences, or preferences, of the participants, such as challenging versus less challenging exercises.

Strengths and limitations

This study contains several strengths: The first strength, as compared to (many) other previous studies on LY, is that it included a control group, thus making it possible to compare the two groups and minimizing the effect of all variables, except on the LY intervention itself. The second strength of this study was that scientifically validated psychometrical measurements were used (i.e. Lamers et al., 2011; Neff, 2003b) instruments which were not used in some other studies on LY. The third and final strength is that there is more ecological validity than in previous studies, which mainly focused on elderly people from a specific country. In contrast, here a wide variety of age groups and nationalities (European and non-European countries) was used.

Nevertheless, some limitations also apply to this study. The first limitation is that the effect of LY may not only be attributable to laughter as such, but also to mediation-related exercises, such as the social setting of LY, or the mindfulness-based elements as positive psychological techniques, e.g. observing emotions and thoughts in the present moment. For a scientifically validated positive psychology intervention it is important to discern which particular components are effective, even though a method as a whole works well (Gonot-Schoupinsky & Garip, 2018). More knowledge about the different parts in LY is therefore of the utmost importance.

A second limitation may lie in the design of this study, namely that participants were not randomly assigned to one of the conditions but were instead assigned based on convenience sampling. This may have threatened the internal validity of the study, due to the group's pre-existing interests and intentions to join in the LY intervention. However, as almost all recruited participants were motivated to join the intervention group, the threat on the internal validity of the study is seemingly unlikely. However, it is advised to, additionally, include an active control group (e.g. Yoga) to the LY, and the wait-list control group, in order to control for placebo effects, in future research.

A final limitation is that the author of this study was also the LY instructor for the surveyed LY interventions. This may have created response bias, meaning that participants may

have answered the questions, such as satisfaction of the intervention, in a way that favors the researcher, which may skew results. Therefore, a neutral LY instructor is needed in future studies. A general future recommendation would be to investigate more in the experience of simulated laughter in LY and clearly separate the LY components to better understand their effectiveness.

Conclusion

Although research on LY is still in its infancy, an attempt was made to fill the gap of the currently existing scientific evidence by exploring the user experience of LY and its effectiveness on different concepts. The current study could not demonstrate a significant effectiveness of LY on mental well-being, self-compassion and health promoting behaviors, when comparing this with the control group. In addition, self-compassion could not be seen as an underlying working mechanism in the relation of LY and mental well-being. However, the study's findings suggest that the emotional well-being subscale, referring to a hedonic form of well-being, can be significantly cultivated in LY. Finally, the LY intervention was very positively experienced by the majority of the participants. However, more research is of utmost importance to better understand the mechanism of LY. On the basis of this study it can be concluded that LY may be a suitable positive, psychological intervention enhancing hedonic well-being.

'Let your smile change the world, but don't let the world change your smile.' (Madan Kataria)

References

Ajzen, I. (2006). Constructing a theory of planned behavior questionnaire.

Antonovsky A (1997) Salutogenese. Zur Entmystifi-zierung der Gesundheit. Dgvt, Tübingen

Beckman Greene, C. M., Morgan, J. C., Traywick, L. S., & Mingo, C. A. (2016). Evaluation of a Laughter-based Exercise Program on Health and Self-efficacy for Exercise. *The Gerontologist*, *57*(6), 1051-1061.

Bennett, M. P., Zeller, J. M., Rosenberg, L., & McCann, J. (2003). The effect of mirthful Laughter on stress and natural killer cell activity

Blättner, B. (2007). Das Modell der Salutogenese. *Prävention und Gesundheitsförderung*, *2*(2), 67-73.

Bennett, M. P., & Lengacher, C. (2008). Humor and laughter may influence health: III. Laughter and health outcomes. *Evidence-Based Complementary and Alternative Medicine*, *5*(1), 37-40.

Blömker, Liisa. Joanna Raphaela (2015): Lach-Yoga und Gesundheit – Eine qualitative Interviewstudie mit den TeilnehmerInnen eines Lach-Yoga-Kurses. Master-Thesis der Kath.Hochschule NRW, Abteilung Köln.

Caruana, F. (2017). Laughter as a Neurochemical Mechanism Aimed at Reinforcing Social Bonds: Integrating Evidence from Opioidergic Activity and Brain Stimulation. *Journal of Neuroscience*, *37*(36), 8581-8582.

Cohen, J. (1988). Set correlation and contingency tables. *Applied Psychological Measurement*, *12*(4), 425-434.

Colom, G. G., Alcover, C. T., Sanchez-Curto, C., & Zarate-Osuna, J. (2011).Study of the effect of positive humour as a variable that reduces stress.Relationship of humour with personality and performance variables. Psychology in Spain, 15(1), 9 – 21.

Crews, D. A., Stolz-Newton, M., & Grant, N. S. (2016). The use of yoga to build self-compassion as a healing method for survivors of sexual violence. *Journal of Religion & Spirituality in Social Work: Social Thought*, *35*(3), 139-156.

Darwin, C. R. (1872). The expression of emotions in man and animals.London: John Murray.

DeCaro, D. S., & Brown, J. L. C. (2016). Laughter Yoga, Adults Living With Parkinson′ s Disease, and Caregivers: A Pilot Study. *Explore: The Journal of Science and Healing*, *12*(3), 196-199.

Deci, E. L., & Ryan, R. M. (2008). Hedonia, eudaimonia, and well-being: An introduction.Journal ofHappiness Studies, 9, 1–11.

Dunbar, R. I., Baron, R., Frangou, A., Pearce, E., Van Leeuwen, E. J., Stow, J., ... & Van Vugt, M. (2011). Social laughter is correlated with an elevated pain threshold. *Proceedings of the Royal Society B: Biological Sciences*, *279*(1731), 1161-1167.

Ei, O. H. (2011). Effects of Laughter Therapy on Depression, Quality of Life, Resilience and Immune Responses in Breast Cancer Survivors. *Journal of Korean academy of nursing*, *41*(3).

Ellis, J. M., Ben-Moshe, R., & Teshuva, K. (2017). Laughter yoga activities for older people l living in residential aged care homes: A feasibility study. *Australasian journal on ageing*, *36*(3), E28-E31

Farifteh, S., Mohammadi-Aria, A., Kiamanesh, A. & Mofid, B. (2014) The impact of laughter yoga on the stress of cancer patients before chemotherapy. Iran. J. Cancer Prev., 7, 179-183.

Fukuoka, A., Ueda, M., Ariyama, Y., Iwai, K., Kai, Y., Kunimatsu, M., ... & Kimura, H. (2016). Effect of Laughter Yoga on Pulmonary Rehabilitation in Patients with Chronic Obstructive Pulmonary Disease.

Greene, C. M., Morgan, J. C., Traywick, L. S., & Mingo, C. A. (2016). Evaluation of a Laughter-based Exercise Program on Health and Self-efficacy for Exercise. *The Gerontologist*, *57*(6), 1051-1061.

Gonot-Schoupinsky, F. N., & Garip, G. (2018). Laughter and humour interventions for well-being in older adults: A systematic review and intervention classification. *Complementary therapies in medicine*, *38*, 85-91.

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. Communication monographs, 76(4), 408-420.

Hupfeld, J., & Ruffieux, N. (2011). Validierung einer deutschen version der Self-CompassionScale (SCS-D). *Zeitschrift für klinische Psychologie und Psychotherapie*.

Kataria, M. (2011). Laugh for no reason (4th ed.). Mumbai, India:Madhuri International.

Kashdan, T. B., Yarbro, J., McKnight, P. E., &Nezlek, J. B. (2014). Laughter with someone else leads to future social rewards: Temporal change using experience sampling methodology. *Personality and Individual Differences*, *58*, 15-19.

Keyes, C.L.M. (2002). The mental health continuum: From languishing to flourishing in life. *Journal of Health and Social Behavior*, 43(2), 207–222.

Kurtz, L. E., & Algoe, S. B. (2015). Putting laughter in context: Shared laughter as behavioral indicator of relationship well-being. *Personal Relationships*, *22*(4), 573-590

Laird, J. D. (1974). Self-attribution of emotion: The effects of expressivebehavior on the quality of emotional experience. Journal of Personal-ity and Social Psychology, 29, 475-486

Lamers, S., Westerhof, G., Bohlmeijer, E., ten Klooster, P., & Keyes, C. (2011). Evaluating the psychometric properties of the mental health continuum short form (MHCSF). Journal of Clinical Psychology, 67(1), 99–110. doi:10.1002/jclp.20741

Lindzus, L. (2017). Lach dich gemeinsam frei! – Affektives Selbstmanagement durch Lachyoga.Masterarbeit der freien Universität zu Berlin.

Martin, R. A., & Ford, T. (2018). *The psychology of humor: An integrative approach*. Academic press.

Martin, R. A. (2002). Is laughter the best medicine? Humor, laughter, and physical health. *Current directions in psychological science*, *11*(6), 216-220.

Mora-Ripoll, R. (2011). Potential health benefits of simulated laughter: a narrative review of the literature and recommendations for future research. *Complementary Therapies in Medicine*, *19*(3), 170-177.

Neff, K. D. (2003b). The development and validation of a scale to measure self-compassion. Self and Identity, 2(3),223–250.

Neff, K. D., & Lamb, L. M. (2009). Self-compassion. *Handbook of individual differences in social behavior*, 561-573.

Noah, T., Schul, Y., & Mayo, R. (2018). When both the original study and its failed replication are correct: Feeling observed eliminates the facial-feedback effect. *Journal of personality and social psychology*, *114*(5), 657.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior research methods, instruments, & computers*, *36*(4), 717-731.

Provine, R. R. (2001). *Laughter: A scientific investigation*. Penguin.

Provine R.R. (2012). Curious behavior: yawning, laughing, hiccupping, and beyond. Cambridge, MA: Harvard University Press.

Provine, R. R. (2017). Laughter as an approach to vocal evolution: The bipedal theory. *Psychonomic bulletin & review*, *24*(1), 238-244.

Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual review of psychology*, *52*(1), 141-166.

Seligman, M. E. P. & Csikszentmihalyi, M. (2000). Positive Psychology: An Introduction. American Psychologist, 55(1), 5–13. doi: 10.1037/0003-066X.55.1.5

Shahidi, M., Mojtahed, A., Modabbernia, A., Mojtahed, M., Shafiabady, A., Delavar, A. ,&Honari, H. (2011). Laughter yoga versus group exercise program in elderly depressed women: a randomized controlled trial. *International journal of geriatric psychiatry*, *26*(3), 322-327.

Shin, N. Y., & Lim, Y. J. (2018). Contribution of self-compassion to positive mental health among Korean university students. *International Journal of Psychology.*

Sin, N. L., & Lyubomirsky, S. (2009). Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-analysis. *Journal of clinical psychology*, *65*(5), 467-487.

Sirois, F. M. (2001). The Wellness Behaviors Inventory. Unpublished manual. Psychology. Carleton University. Ottawa.

Snaith, N., Schultz, T., Proeve, M., & Rasmussen, P. (2018). Mindfulness, self-compassion, anxiety and depression measures in South Australian yoga participants: implications for designing a yoga intervention. *Complementary therapies in clinical practice*, *32*, 92-99.

Strack, F., Martin, L. L., & Stepper, S. (1988). Inhibiting and facilitating conditions of the human smile: a nonobtrusive test of the facial feedback hypothesis. *Journal of personality and social psychology*, *54*(5), 768.

Szameitat, D. P., Alter, K., Szameitat, A. J., Darwin, C. J., Wildgruber, D., Dietrich, S., & Sterr, A. (2009). Differentiation of emotions in laughter at the behavioral level. *Emotion*, *9*(3), 397.

Trompetter, H. R., de Kleine, E., & Bohlmeijer, E. T. (2017). Why does positive mental Health buffer against psychopathology? An exploratory study on self-compassion as a resilience mechanism and adaptive emotion regulation strategy. *Cognitive therapy and research*, *41*(3), 459-468.

Van Uden-Kraan, C. F., Chinapaw, M. M., Drossaert, C. H., Verdonck-de Leeuw, I. M., &Buffart, L. M. (2013). Cancer patients' experiences with and perceived outcomes of yoga: results from focus groups. *Supportive care in cancer*, *21*(7), 1861-1870.

Wagenmakers, E. J., Beek, T., Dijkhoff, L., Gronau, Q. F., Acosta, A., Adams Jr, R. B., ... & Bulnes, L. C. (2016). Registered Replication Report: Strack, Martin, & Stepper (1988). *Perspectives on Psychological Science*, *11*(6), 917-928.

Webb, G. R., Redman, S., Gibberd, R. W., & Sanson-Fisher, R. W. (1991). The reliability and stability of a quantity-frequency method and a diary method of measuring alcohol consumption. *Drug and Alcohol Dependence*, *27*(3), 223-231.

World Health Organisation. (2004). Promoting mental health: Concepts, emerging evidence, practice (Summary report). Genève: WHO.