# Spontaneous Laughter, Simulated Laughter, and Laughter Therapies/Yoga: A Scoping Review (Part I)

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**Abstract**: This article provides a scoping review of more than 400 studies on laughter over the past 50 years. Given the number of studies and length of this review, it will be published in two parts. It builds on the 28 previous reviews and clarifies laughter terminology to parse out fact from fiction. The review concentrates on neurological laughter research and the differences between spontaneous (real) and simulated (fake) laughter, and laughter therapies/laughter yoga. It partitions the studies according to various physiological and psychosocial outcome measures. Those measures form the foundation for clinical applications of laughter. Unlike numerous previous reviews, this one also examines the quality and quantity of laughter research and the harmful effects of spontaneous laughter. The evidence accumulated on these topics indicates that spontaneous, not simulated, laughter or laughter therapy produces the strongest neurological and physiological outcomes. The primary effects from 133 studies include decreased cortisol and catecholamines (stress hormones), increased natural killer (NK) cell activity and immunoglobulins (immune system), reduced cardiovascular disease, decreased blood pressure, increased pulmonary functions, and release of endorphins. In contrast, there are only five studies on simulated laughter. More than 200 studies of laughter therapies over the past 20 years found decreased cortisol, blood pressure, and blood glucose. Psychosocially, most of the research produced decreased stress, depression, and anxiety, increased pain tolerance, and improved mood. These trends should be considered tentative due to the lack of comparability among the different therapies. Each therapy typically contains a variety of exercises (simulated laughter, stretching, dancing, clapping, breathing, and meditation) administered in a group environment. There are no standard therapeutic techniques, prescriptions, or protocols. This lack of standardization renders inferences about their effectiveness for clinical and research applications nearly impossible. Specific recommendations address previous studies' weaknesses to improve future research quality.[2]

**Keywords**: Laughter, Spontaneous Laughter, Simulated Laughter, Mirthful Laughter, Laughter Yoga, Laughter Therapy, Laughter Research

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[2] This article is dedicated to the memory of my dear friend, mentor, and colleague Dr. Lee S. Berk. His pioneering work in psychoneuroimmunology and the therapeutic benefits of mirthful laughter inspired countless researchers, practitioners, and educators around the world. His ground-breaking research beginning in the 1980s to the present gave us new insights into humor, laughter, and health. Our conversations about whether this article should be written are indelibly marked in my memory. This review would not have been tackled without his encouragement. He will be greatly missed. I hope the contents and his contributions cited herein will honor his legacy.

## Introduction

Health information constantly bombards our lives from Public Broadcasting Service (PBS) special programs, podcasts, commercials, social media, print media, emails, and videos. Those sources prescribe what to eat, what medications to take, and what exercises to perform. Rarely do they formally acknowledge the value of any specific mental or physical benefits of laughter. It is given only a passing glance by most health professionals with the worn-out cliché, "laughter is the best medicine." The medical community is divided on the therapeutic legitimacy of laughter (Balick & Lee, 2003). It is often classified under the rubric *alternative* or *complementary medicine* (Ripoll & Casado, 2010).

This article will parse fact from fiction in the research accumulated over the past 50 years. Due to the number of studies and length of this review, it will be published in two parts and address a dozen topics: *Part 1* will concentrate on the following eight: (1) review search methods, (2) previous reviews of laughter research, (3) backstory of laughter research, (4) laughter terminology, (5) neurological research on laughter, (6) research profile of spontaneous laughter, (7) research profile of simulated laughter, and (8) research profile of laughter therapies and laughter yoga; *Part 2*, to be published in 2026, will cover four topics: (9) harmful effects of spontaneous laughter, (10) quality and quantity of laughter research, (11) conclusions, and (12) limitations of the review. Welcome to Part 1. Fasten your seatbelt.

## Review Search Methods

### *Design*

This scoping review followed Peters et al. (2015) guidelines of the Joanna Briggs Institute, University of Adelaide, AU. Since there are numerous study-by-study narrative reviews and

meta-analyses of laughter research, this review focused on the "reconnaissance mission" to clarify working definitions of laughter and conceptual boundaries for the research ((Davis, Drey, & Gould, 2009). It extracted the essence of the diverse body of evidence on laughter to give it meaning and significance for therapeutic applications.

### *Search Strategy*

This review was built on the previous reviews plus electronic database searches PubMed, PsychINFO, Web of Science, and Google Scholar. ResearchGate.net and Academia.edu were also used to track down articles. The searches included published (peer-reviewed) and unpublished studies (grey literature) in English, especially conference presentations and reviews of laughter research. Correlational studies and pre-experimental, quasi-experimental, and true-experimental designs were included to assess the overall quality and quantity of studies in different categories.

Emphasis was placed on laughter interventions with specific outcome benefits for the patients or participants of any age who are healthy or with specific mental or physical health conditions in any clinical setting. The intervention, control, and outcome measures could be administered to participants in any physical position—standing up, sitting in a chair/wheelchair, or lying down with or without props.

Spontaneous laughter physiological research was searched between 1970 and 2023; simulated laughter, laughter therapy, and laughter yoga physiological and psychosocial research were searched from 2000 to 2023. Neurological research was also searched for the last two decades. The "snowball method" supplemented all "keyword" electronic searches. Relevant

articles generated by those searches and references in identified articles were reviewed manually for additional studies to update previous reviews.

### *Screening and Data Extraction*

The title/abstract keywords used in the database searches resulted in the following initial unrestricted article counts: laughter (2506), real laughter (27), mirthful laughter (76), spontaneous laughter (92), fake laughter (4), simulated laughter (29), laughter therapy (597), and laughter yoga (603). Duplicate, descriptive, nonresearch (e.g., case study), and other articles and books were evaluated for relevance. Humor research was excluded except where humor (jokes, comedy videos, stand-up comedians) served as the stimulus for spontaneous laughter, not for simulated laughter and laughter therapy.

### *Classification of Data*

The remaining articles were then consolidated as follows for this scoping review:

- Previous reviews of laughter research (28),
- Neurological research on laughter (34),
- Spontaneous physiological laughter (133),
- Simulated physiological laughter (2),
- Simulated psychosocial laughter (3),
- Laughter therapy and laughter yoga physiological (41),
- Laughter therapy and laughter yoga psychosocial (169)

All 410 studies were grouped by their outcome effects to provide profiles, albeit distributions, in the preceding categories. Each profile will reveal the areas of research with the heaviest and lightest concentrations and identify the glaring gaps.

**Previous Reviews of Laughter Research**

There are 28 narrative, systematic, scoping, and meta-analytic reviews of 10 categories of laughter research: *spontaneous (mirthful) laughter* (Devereux & Heffner, 2007; Ferner & Aronson, 2013; Kramer & Leitao, 2023; Provine, 2000), *spontaneous (mirthful) laughter and laughter therapy* (Louie, Brook, & Frates, 2014; van der Wal & Kok, 2019; Zhao et al., 2019), *simulated laughter* (Mora-Ripoll, 2011); *humor and laughter* (Berk, 2001, 2002; Gonot-Schoupinsky, Garip, & Sheffield, 2020; Martin, 2001; Martin & Ford, 2018; McCreaddie & Wiggins, 2008; Rindfleisch, 2018), *humor and laughter therapy* (Pérez-Aranda et al., 2019; Stevens & Avila, 2013), *laughter yoga* (Alici & Dönmez, 2020; Bressington et al., 2018), *laughter yoga and therapy* (Gonot-Schoupinsky & Garip, 2018), *laughter therapy* (Bahari & Lorica, 2019; Bennett et al., 2014; Kang, 2017; Sridharan & Sivaramakrishnan, 2016; Yim, 2016), and *laughter-induced interventions* (all of preceding) (Kafle et al., 2023; Oliveia & Arriaga, 2022; Stiwi & Rosendahl, 2022).

The most comprehensive study-by-study critiques were conducted by van der Wal and Kok (2019) and Gonot-Schoupinsky et al. (2020) and in the books by Martin and Ford (2018) and Provine (2000). Descriptions of *laughter therapy* research results and techniques were presented by Mora-Ripoll (2010, 2017), Mora-Ripoll (2011), and Ripoll and Casado (2010). Neurological research on laughter was previously summarized in the books by Martin and Ford (2018) and Provine (2000), briefly reviewed by Gonot-Schoupinsky et al. (2020), and mentioned

by Louie et al. (2014). The most thorough review of humor research, a topic not covered in this review, was written by Martin and Ford (2018).

The preceding 10 review categories and the other descriptive reviews are incomplete, fragmented, inconsistent, redundant, and confusing. What does all of this mean? It is time to Sherlock the terms to clarify the direction of this review. Even more important is: *What is the point of conducting another review?* There are so many questions on laughter's mental and physical benefits for which we do not have answers. What does the evidence tell us we know and do not know?

Those benefits have been constantly mentioned in popular media and by clinicians and researchers for over 50 years. Has the laundry list of benefits been put to rest? Yim (2016, p. 245) summarized the list of mental benefits as follows:

- Reduces stress, anxiety, and tension, and counteracts symptoms of depression
- Elevates mood, self-esteem, hope, energy, and vigor
- Enhances memory and creative thinking
- Improves interpersonal interaction
- Increases friendliness and helpfulness
- Promotes psychological well-being
- Improves quality of life and patient care
- Intensifies mirth and is contagious

The physical benefits include:

- Exercises and relaxes muscles
- Improves respiration
- Stimulates circulation

- Decreases stress hormones
- Increases the immune system's defenses
- Elevates pain threshold and tolerance
- Enhances mental functioning

Unfortunately, the answer is "no" to the previous questions. Despite the popularity of those lists, the research evidence to support those claims is controvertible. From the 1970s to the present, the accumulating results have been called into question due to the dearth of studies, their uneven quality, and the inconsistency of results (Gonot-Schoupinsky et al., 2020; Martin & Ford, 2018; Stiwi & Rosendahl, 2022; van der Wal & Kok, 2019). There is also confusion over "laughter" terminology and the validity and generalizability of the answers in previous reviews. While there is some overlap in the studies and even conclusions in several reviews, they all vary across the types of laughter research, search strategies, human subjects, sampling methods, research designs, outcome measures, and inclusion and exclusion criteria.

## Backstory of Laughter Research

### *Types of Laughter*

Yim (2016) identified five types of laughter: (1) *spontaneous (real) laughter,* which is triggered by a funny stimulus, (2) *simulated (fake) laughter,* which is self-induced with no specific reason or stimuli, (3) *stimulated laughter,* which results from physical contact or reflexes, such a tickling, facial or bodily motions, or touching laughter bones, (4) *induced laughter,* which is the effect of drugs or related substances, such as alcohol, amphetamines, cannabis, or nitrous oxide (laughing gas), and (5) *pathological laughter,* which is caused by injuries to the central nervous system, neurological diseases, or psychiatric disorders.

The bulk of the research on laughter has focused on the first two categories (Mora-Ripoll, 2011, 2017; Ripoll & Casado, 2010; van der Wal & Kok, 2019; Yim, 2016). These categories differ according to how the laughter is induced. The emergence of research on simulated and therapeutic laughter has dominated the literature on laughter over the past two decades.

### *Spontaneous (Real) Laughter*

Spontaneous laughter was studied in the earliest experimental research where a TV or movie comedy or stand-up comedian was used to stimulate individual laughter. Later, YouTube videos were used. Humor was typically the stimulus to elicit laughter. It produced the authentic laughter we associate with belly-jiggling laughs, rolling in the aisle, and guffaws in response to jokes. The control group experienced a drama, documentary, or nothing. The biochemical outcomes were measured in blood and saliva assays along with heart rate and blood pressure.

The search for this review was initially intended to identify what physiological research followed in the years since the original baseline period of 1970s–1980s. Over the past 30 years, did the subsequent research corroborate or extend the early studies that were often limited in sample size, selection, and research design? More than 100 studies tell the story over that period.

### *Simulated (Fake) Laughter*

This laughter is voluntary and consciously triggered in an individual or controlled group environment without a humor stimulus. There is no funny trigger. A laughter leader physically forces it. The search for this type of laughter revealed almost nothing. Over the past 20 years, two physiological and three psychological investigations have occurred. We know nearly nothing about the outcomes or benefits of simulated laughter compared to spontaneous laughter.

### *Laughter Therapy*

As this story unspools and the search continues, simulated laughter research becomes embedded in laughter therapy with various laughter exercises and meditation with yoga breathing. Although "simulated laughter" was still used in research titles/abstracts, multiple activities were conflated to create a single laughter package of exercises to provide therapies for specific participants or patients. Here is where the story of simulated laughter unravels. The package has no standard therapeutic technique, prescription, or protocol for the simulated laughter or other components.

### *Laughter Yoga*

Over this period, a laughter therapy technique called "laughter yoga" popped up in India. It was created by physician Dr. Madan Kataria in 1995. This laughter plus yoga combo became a worldwide movement, with over 20,000 laughter clubs in 120 countries (Kataria, 2021). It is being practiced in senior and age-care centers, K–12 schools and colleges, companies, corporations, factories, facilities for physically- and mentally-challenged people, police departments, and prisons.

The therapy begins with simulated laughter ("laugh for no reason") as a physical exercise warm-up in a group setting, followed by stretching, clapping, dancing, relaxation, breathing, and laughter exercises. It concludes with meditation (Kataria, 2020). Laughter yoga contains multiple activities in an infinite number of forms. Similar to laughter therapy, laughter yoga has no standard therapeutic technique, prescription, or protocol (Mora-Ripoll, 2017; Louie, Brook, & Frates, 2014; van der Wal & Kok, 2019; Woodbury-Fariña & Schwabe, 2015). A few studies of laughter therapies even begin with a humorous stimulus, which violates the dominant format.

### *Laughter Yoga vs Laughter Therapy*

The characteristics of laughter therapy resemble those of laughter yoga. The differences between the therapies get murky as you scrutinize the elements in various studies. There are numerous resources on a wide variety of possible elements that can be included in the therapy mix, especially laughter yoga (Gendry, 2007, 2015; Hahn, 2006; Kataria, 2010, 2020; Mora-Ripoll, 2017; Ripoll & Casado, 2010).

Gentry (2010) identified four categories of laughter exercises: (1) emotional wellness (pantomiming laughter), (2) physical workout (aerobic and strength training), (3) playful behaviors, and (4) special techniques (cross-brain, singing, dancing, and floor exercises, games, and meditation). There are infinite exercises and possible combinations of those exercises in any therapy package (Mora-Ripoll, 2017). It is a McDonald's Happy Meal® with several delectable goodies and treats (aka therapeutic exercises).

### Laughter Terminology

The preceding descriptions have produced a myriad of terms in the research, which create a lot of confusion. Here is a list of terms for *spontaneous* and *simulated* laughter used in the titles of the studies:

| ***Spontaneous Laughter*** | ***Simulated Laughter*** |
|---|---|
| Real | Fake |
| Mirthful | Unconditional |
| Unforced | Forced |
| Stimulus-driven | Context-driven |

| | |
|---|---|
| Involuntary | Voluntary/Volitional |
| Emotionally valent | Emotionless |
| Humor-Induced | Nonhumor-Induced |
| Duchenne | Non-Duchenne |
| Authentic | Self-induced |
| | Laughter Therapy |
| | Laughter Yoga |
| | Laughter-Induced |
| | Laughter Meditation |

***Assumptions Underlying Simulated Laughter and Laughter Therapies***

There are claims in the literature that the psychological and physiological research evidence from spontaneous laughter studies can be generalized to simulated laughter and laughter therapies (Alici & Dönmez, 2020; Mora-Ripoll, 2011, 2017; Yim, 2016). Researchers argue that the group simulated-laughter exercises will eventually morph into contagious spontaneous laughter as participants make eye contact with others laughing (Mora-Ripoll, 2017). If that shift to spontaneous is sustained long enough, then the benefits of spontaneous laughter should result. There is no research evidence to support that notion.

***"Motion Creates Emotion Theory" of Simulated Laughter***

Several researchers have compared the characteristics of spontaneous and simulated laughter (Louie, Brook, & Frates, 2014; Mora-Ripoll, 2011, 2017; van der Wal & Kok, 2019; Yim, 2016) in their literature reviews. Dr. Kataria proposed the *Motion Creates Emotion Theory*, arguing that

the human mind can distinguish between those types of laughter, but the body cannot. Consequently, "their corresponding health-related benefits are alleged to be alike" (Mora-Ripoll, 2017, p. 2). In other words, the physical act of laughing should produce the same physiological and psychological effects regardless of how it is created, with or without a humorous stimulus. The research-based effects found for spontaneous laughter should be able to be generalized to simulated laughter.

Unfortunately, there is no evidence to support Kataria's theory. Only one randomized control group study compared the two types of laughter (Law, Broadbent, & Sollers, 2018). Those researchers found differences in the cardiovascular effects of increased heart rate and decreased heart rate variability that simulate exercise. Increased intensity and frequency of laughter did not explain those differences.

Simulated laughter is rarely executed as a singular activity with one person. It is frequently led by a certified laughter or yoga leader along with therapeutic exercises in a group setting. When participants see each other laugh and engage in playful behaviors, the simulated laughter can increase in intensity and duration to transition into spontaneous laughter. Eye contact and positive emotions have a contagious effect on everyone involved. This combination of different laughter techniques becomes a package of activities rather than just laughter.

Simulated laughter is embedded in that package as just one of the ingredients in the group experience. Therein lies the confounding factor for research and clinical interpretations. The research on laughter therapy, laughter yoga, and other laughter-induced techniques yields outcomes on the package, not on the individual contributing ingredients. The positive effects on stress, blood pressure, the immune system, and other variables are attributable to the package. The results do not isolate the laughter or non-laughter element, such as clapping, dancing,

breathing, relaxation exercises, or meditation to explain the effects. There is no clue which element contributed or how much.

## Neurological Research on Laughter

Brain research on laughter is rarely mentioned in reviews of laughter research (Gonot-Schoupinsky et al., 2020; Louie, Brook, & Frates, 2014; Martin & Ford, 2018; Pearce, 2004). The research on very small samples indicated different neural and emotional pathways for the two types of laughter (Dunbar et al., 2012; Gervais & Wilson, 2005; Wattendorf et al., 2012). Much of this information is derived from studies of people with brain lesions (Wild, Rodden, Grodd, & Ruch, 2003).

### *Spontaneous Laughter Involves Multimodal Behavior*

Physiologically, spontaneous laughter is described as a multimodal behavior that affects the whole body—visually (facial expressions), auditorily (vocal output), and with thoracic muscle spasms (Fry, 1994; Lavan & McGettigan, 2017; Luscei et al., 2006; Niewiadomski et al., 2014; Ruch & Ekman, 2001). The laughter processes and synchronizes these behaviors automatically. It has not been possible to reproduce all those behaviors with simulated laughter

### *Spontaneous Laughter Produces Positive Emotional Feelings*

Neuroimaging of the brain with positron emission tomography (PET) and magnetic resonance imaging (MRI) scans measured the magnitude of real facial "Duchenne" smiles (named after the French neurologist Guillaume Duchenne, who researched the physiology of facial expressions in the mid-19th century) (Duchenne, 1990; Ekman, Davidson, & Friesen, 1990). The scans also

measured pleasant emotions (positive mood) and the intensity of laughter. Participants viewed comic film clips of British comedian "Mr. Bean" (Iwase et al., 2002; McGettigan et al., 2015; Yamao et al., 2015). Those responses were compared to posed, voluntary simulated movement, mimicking laughing without emotional contents. The humorous stimuli produced the cognitive and experiential processing of emotions.

There have been very few neuroimaging studies on processing humor and laughter in various brain regions (Marinkovic et al., 2011; Vrticka, Black, & Reiss, 2013). Meta-analyses of 57 MRI studies (6 with laughter) indicated picture-driven, text-based, and auditory laughter cues activated areas of the brain associated with emotional processes (Farkas et al., 2021). Those emotions from spontaneous laughter that may range from mild amusement to high levels of hilarity are referred to as *mirth* (Martin & Ford, 2018, p. 6). No such processing or emotions resulted from simulated laughter.

***Spontaneous Laughter Sounds Differently from Simulated Laughter***

Compared to simulated laughter, spontaneous laughter is acoustically different (Anikin & Lima, 2017; Bryant et al., 2016; Szameitat et al., 2009) and is linked to arousal by the stimulus with greater intensity, variability, higher pitch, and increased noisy features (Bryant & Aktipis, 2014; Lavan & McGettigan, 2017; Lavan, Scott, & McGettigan, 2016; Lavan et al., 2017; Luschei at al., 2006; McGettigan, 2014; McGettigan et al., 2015). The vocalizer's emotional state and facial expressions enable listeners to discriminate spontaneous from simulated laughs (Lima et al., 2021; McKeown, Sneddon, & Curran, 2015; Neves et al., 2018). The most recent large-scale study by Bryant et al. (2018) tested 36 recorded laughs with 884 participants from 21 societies across six world regions. Regardless of culture, native language, or linguistic similarity to the

vocalizer, the participants in every society correctly identified real and fake laughs with 56–69% accuracy.

### *Spontaneous Laughter Is Contagious*

The brain automatically detects the difference between laughter made under different emotional states. Laughing in a group makes a difference. Laughter and cheering are typically performed in social groups; Provine (1992, 2000) estimated that we are 30 times more likely to laugh with other people than alone. Just hearing the sound of laughter may be sufficient to trigger laughter (Amir, Biederman, Wang, & Xu, 2015).

Spontaneous laughs are more contagious than simulated laughs, regarding how happy people felt upon hearing those laughs and how much they make them want to join in (Neves et al., 2018; Provine, 1992). No difference existed in how much the motor regions activated in response to the two types of laughs. On reflection, perhaps this wasn't surprising – "canned laughter" or live audience laughter has remained in television because it makes people laugh, even though they typically report that they do not find the sound pleasant or amusing.

### *Spontaneous Laughter Fosters Social Bonding*

We laugh more frequently during conversations than in any other activity. Laughing together with colleagues, friends, and family signals our connection to them. It promotes social bonding, feelings of togetherness, and sexual encounters (Caruana, 2017; Dunbar, 2022; Dunbar et al., 2012; Grammer, 1990; Manninen et al., 2017). Observations of other's laughing and their emotions activate the same brain centers involved in producing laughter (Caruana et al., 2020;

Caruana, Palagi, & de Waal, 2022). Laughter modulates interpersonal bonds, making large social networks possible.

### *Spontaneous Laughter Triggers the Release of Endorphins*

This laughter triggers the release of endorphins ("feel-good hormones") in the brain regions responsible for arousal and emotion (Iwase, 2002). They are a class of endogenous opioid peptides produced by the central nervous system, which function as neurotransmitters to manage pain and buffer against stress (Akil, Madden, Patrick, & Barchas, 1976; Basbaum & Fields, 1984; Bloom, 1983). Our brain automatically detects the difference between laughter made under different emotional states. Only spontaneous laughter can mitigate negative emotions and stress.

PET imaging monitored a significant increase in endorphins after 12 healthy men watched humorous video clips of their close friends. The endorphins induced by spontaneous social laughter interacted with opioid receptors to relieve pain and produce feelings of pleasure, supporting the formation and maintenance of social bonds (Manninen et al., 2017). Spontaneous laughter is intensely social and contagious. There is no evidence that those same effects are produced from simulated laughter.

Spontaneous laughter in a group creates positive emotions and releases endorphins that make you feel pleasure, decrease pain, and foster social bonding. It is the "gold standard" for laughter. No neurological research exists on simulated laughter in a group setting, such as laughter therapy or laughter yoga.

**Research Profile of Spontaneous Laughter (Physiological Effects)**

The research evidence on the effects of laughter has been accumulating for more than 50 years. This profile identified 134 studies (Table 1). Norman Cousins' (1979) groundbreaking applications of laughter to eliminate the pain he suffered from ankylosing spondylitis grabbed the research community's attention.

This birth of "laughter therapy" and the recognition of its clinical potential was followed by a wave of physiological research in the 1970s and 80s by pioneers Dr. Lee Berk of Loma Linda University School of Medicine and Dr. William Fry of Stanford University School of Medicine. They established a baseline for the scientific study of laughter (aka "gelotology"). Their research measured the effects of laughter on serum cortisol and catecholamines, epinephrine, growth hormone, dopamine, blood pressure, heart rate, respiration, and natural killer cell activity. Over the past 30 years, Dr. Berk and his colleagues continued their research on laughter's impact on memory and recall, endorphins, cognitive function and self-perception, inflammation, and mood.

**Table 1: Research Profile of Physiological Outcome Effects of Spontaneous (Mirthful) Laughter (50 yrs)**

***Increases Natural Killer (NK) Cell Activity*** (Bennett, 1997; Bennett & Lengacher, 2009; Bennett, Zeller, Rosenberg, & McCann, 2003; Berk et al., 1984, 1989a, 2001; Berk & Tan, 1996; Berk, Tan, & Fry, 1993; Berk, Tan, Napier, & Eby, 1989b; Hayashi et al., 2007; Itami, Nobori, & Teshima, 1994; Kamei, Kumano, & Masumura, 1997; Lefcourt, Davidson-Katz, & Kueneman,

1990; Mittwoch-Jaffe, Shalit, Srendi, & Yehuda, 1995; Takahashi et al., 2001; Wise, 1989; Yoshikawa et al., 2019; Yoshino, Fujimori, & Kohda, 1996)

***Decreases Cortisol*** (serum and salivary cortisol and chromogranin A) (Berk, Tan, & Berk, 2008; Berk et al., 1988a, 1988b, 1988c, 1989a, 1989b; Bennett, Zeller, Rosenberg, & McCann, 2003; Cantave et al., 2019; Fry, 1992; Kamei, Kumano, & Masumura, 1997; Kramer & Leitao, 2023; Mallya, Reed, & Yang, 2019; Martin & Dobbin, 1988; Tan, Tan, Lukman, & Berk, 2007–2008; Toda & Ichikawa, 2012; Toda et al., 2007; Yoshikawa et al., 2019)

***Increases Immunoglobulins A(IgA)*** (serum and saliva) (Berk et al., 2001; Dillon, Minchoff, & Baker, 1985; Dillon & Totten, 1989; Harrison et al., 2000; Kimata, 2004; Labott, Ahleman, Wolever, & Martin, 1990; Lambert & Lambert, 1995; Lefcourt, Davidson-Katz, & Keuneman, 1990; Martin & Dobbin, 1988; McClelland & Cheriff, 1997; Njus, Nitschke, & Bryant, 1996; Perera, Sabin, Nelson, & Lowe, 1998)

***Reduces Cardiovascular Disease*** (Boone, Hansen, & Erlandson, 2000; Harrison et al., 2000; Hayashi et al., 2016; Law, Broadbent, & Sollers, 2018; Miller & Fry, 2009; Noureldein, & Eid, 2018; Sakurada et al., 2020; Sugawara, Tarumi, & Tanaka, 2010; Tan et al., 1997; Tan, Tan, Lukman, & Berk, 2007–2008)

***Decreases Blood Pressure*** (Bains et al., 2016, 2018; Eshg, Ezzati, Nasiri, & Ghafouri, 2017; Fry & Savin, 1988; Ikeda et al., 2021; McMahon, Mahmud, & Feely, 2005; Sugawara, Tarumi, & Tanaka, 2010; Tan et al., 1997; Tan, Tan, Lukman, & Berk, 2007–2008; White & Camarena, 1989; Yoshikawa et al., 2019)

***Decreases Catecholamines*** ("fright, flight, fight" effect) (dopamine, norepinephrine, & epinephrine) Berk et al., 1984, 1988a, 1988c; Berk, Tan, & Berk, 2008; Tan et al., 1997; Tan, Tan, Lukman, & Berk, 2007–2008)

***Increases Pulmonary Functions*** (Brutsche et al., 2008; Filippelli et al., 2001; Herxheimer, 1978; Kimata, 2004; Lebowitz, Suh, & Diaz, & Emery, 2011; Liangas, Morton, & Henry, 2003)

***Releases Endorphins*** (Berk & Tan, 2006; Berk et al., 1989b; Dunbar et al., 2012; Iwase et al., 2002; Itami, Nobori, & Teshima, 1994; Manninen et al., 2017; Yoshimo, Fujimora, & Kohda, 1996)

***Increases Respiration and Oxygen Saturation and Consumption*** (Filippelli et al., 2001; Fry, 1971, 1994; Fry & Rader, 1977; Fry, & Stoft, 1971; Lloyd, 1938; Luschei et al., 2006; McClelland & Cheriff, 1997)

***Activates Trunk Muscles*** (Niewiadomski et al., 2014; Ruch & Ekman, 2001; Svebak, 2016; Wagner, Rehmes, Kohle, & Puta, 2014)

***Decreases Heart Rate*** (Averill, 1969; Bains et al., 2016, 2018; Boone, Hansen, & Erlandson, 2000; Fry, 1994; Law, Broadbent, & Sollers, 2018; Sakuragi, Sugiyama, & Takeuchi, 2002; Sugawara, Tarumi, & Tanaka, 2010; White & Camarena, 1989; Yoshikawa et al., 2019)

***Increases Serum Immunoglobulins M, E, G, B cells, and Complement B*** (Berk et al., 1989a, 2001; Berk, Tan, & Fry, 1993; Kimata, 2004)

***Increases Serum Pro- and Anti-inflammatory Cytokine*** (Matsuzaki et al., 2006; Mittwoch-Jaffe, Shalit, Srendi, & Yehuda, 1995)

***Decreases Blood Glucose*** (Hayashi & Murakami, 2009; Hayashi et al., 2003, 2006, 2007; Jaisingh, Vijayalakshmi, & Vijayaraghavan, 2019; Noureldein, & Eid, 2018; Ohira et al., 2015)

***Increases Short-term Memory and Recall*** (Bains et al., 2014, 2015; Berk, Alphonso, Thakker, & Nelson, 2014; Berk, Cavalcanti, & Bains, 2012; Berk et al., 2020)

***Increases Cognitive Function and Sensory Perception*** (Berk et al., 2020; Berk, Alphonso, Thakker, & Nelson, 2014; Mallya, Reed, & Yang, 2019)

***Decreases Growth Hormone*** (Ishigami et al., 2005)

***Increases Serotonin*** (Yoshikawa et al., 2019)

***Increases "Free Radicals"*** (Atsumi et al., 2004)

***Decreases Inflammation*** (Atsumi et al., 2004; Bains et al., 2016, 2018; Matsuzaki et al., 2006)

***Increases Spontaneous Lymphocyte Blastogenesis*** (Berk et al., 1988b, 1989a)

***Increases Circulation and Vascular Function*** (Sugawara, Tarumi, & Tanaka, 2010)

***Protects against Trunk Compression*** (Svebak, 2016)

Despite this concentration on the physiological benefits, the quantity of experimental studies testing for those outcomes pales compared to the volume of research on the psychosocial benefits (Martin, 2001; Martin & Ford, 2018). This review does not consider the latter outcomes since so much has been covered elsewhere. Instead, this review begins with a profile of the early physiological studies (32) and those completed over the last three decades (101). It is intended to be a highlight/lowlight film that pinpoints what outcomes have received the most attention and those that have received the least. The gaps have implications for clinicians and future research efforts. Beyond this profile, the overall quality of research and efficacy of the results will also be addressed.

Since the original studies, researchers have devoted the most attention to natural killer (NK) cell activity and immunoglobulins (immune system), cortisol and catecholamines (stress hormones), cardiovascular disease, blood pressure, pulmonary functions, and endorphins. These outcomes have been measured in blood and saliva assays and PET and MRI brain scans. The most recent 75% of the research indicates significant progress to bolster the quality and quantity of knowledge on the benefits of laughter. Over the past 20 years, studies have focused on various

outcomes, including respiration and oxygen saturation, trunk muscles, heart rate, blood glucose, memory and recall, cognitive function, and inflammation.

**Research Profile of Simulated Laughter (Physiological & Psychosocial Outcomes)**

There are only five studies on the specific effects of individual- or group-simulated laughter (Table 2). The outcomes examined in the research on simulated laughter have been virtually ignored. No valid conclusions can be drawn to recommend simulated laughter by itself for any therapeutic applications.

**Table 2: Research Profile of Simulated Laughter**

**Physiological Outcome Effects of Simulated Laughter**

***Decreases Cortisol*** (Heo, Kim, Park, & Kil, 2016)

***Variable Heart rate*** **(**Law, Broadbent, & Sollers, 2018)

**Psychosocial Outcome Effects of Simulated Laughter**

***Improves Mood*** (Foley, Matheis, & Schaefer, 2002; Heo, Kim, Park, & Kil, 2016; Neuhoff, & Schaefer, 2003)

**Research Profiles of Laughter Therapies/Yoga (Physiological Outcomes)**

The research profiles in this section are based on laughter therapy and laughter yoga interventions conducted over the past 20 years. They contain simulated laughter and other activities typically administered in a group format (Sutorius, 1995). These Happy Meals vary

from study to study. An infinite number of therapy activities and exercises are included in the research on the efficacy of the therapy packages. Without consistent study design, sampling method, intervention, and outcome measures, it isn't easy to synthesize the results for meaningful clinical recommendations. There is no comparability from study to study, even with the same outcomes.

The distribution of *physiological research* is very different from that of real laughter (Table 3). The largest chunk of studies (14) examined cortisol. Others focused on blood pressure, blood glucose, heart rate, and pulmonary function. There is also a sprinkling of one or two studies on various other outcomes. The overall sparsity of research (41 studies) suggests it is only in its infancy, and a considerable amount of effort should concentrate on all of the outcomes, preferably with standardization of research and sampling designs, intervention components, and outcome measures.

**Table 3: Research Profile of Physiological Outcome Effects of Laughter Therapy, Laughter Yoga, and Laughter-Induced Therapy (20 yrs)**

***Decreases Cortisol*** (serum, salivary, breast milk) (Chang, Tsai, & Hsieh, 2013; Cha & Hong, 2013; Choi et al., 2010; Fujisawa et al., 2018; Han et al., 2011; Hsieh, Chang, Tsai, & Wu, 2015; Heo, Kim, Park, & Kil, 2016; Ko, Lee, & Park, 2022; Lee & Lee, 2020; Meier et al., 2021; Nagendra et al., 2007; Oh et al., 2011; Ozturk & Tezel, 2021; Park, Kim, Heo, & Yang, 2007; Shin, Ryu, & Song., 2011)

***Decreases Blood Pressure*** (Bennett et al., 2015; Donelli et al., 2019; Ellis, Ben-Moshe, & Teshuva, 2017; Eshg, Ezzati, Nasiri, & Ghafouri, 2017; Jalali, Kheirkhah, Ahmadi, & Seifi Zarei, 2008; Lee et al., 2013; Miles, Tait, Schure, & Hollis, 2016; Yu & Kim, 2009)

***Decreases Blood Glucose*** (Ahmadi, Bazzazian, Tajeri, & Rajab, 2020; Čokolič, Herodež, Sternad, & Krebs, 2013; Jaisingh, Vijayalakshmi, & Vijayaraghavan, 2019; Kumar, Mohan, Kumar, & Kalra, 2021; Nasir et al., 2005)

***Variable Heart Rate*** (Chae, 2015; Dolgoff-Kaspar et al., 2012; Ellis, Ben-Moshe, & Teshuva, 2017; Miles, Tait, Schure, & Hollis, 2016; Yu & Kim, 2009)

***Increases Pulmonary Function*** (Lebowitz, Suh, Diaz, & Emery, 2011; Salunke, & Shah, 2019)

***Increases Natural Killer (NK) Cell Activity*** (Cho & Oh, 2011; Ryu, Shin, & Yang, 2015)

***Deceases Body Weight and BMI*** (Funakubo et al., 2022)

***Increases Serotonin*** (Cha & Hong, 2015)

***Decreases Hemoglobin $A_1c$*** (Hirosaki et al., 2013)

***Increases Blood Oxygenation*** (Miles, Tait, Schure, & Hollis, 2016)

***Increases Serum/Salivary Immunoglobulin*** (Cha & Hong, 2013; Ko, Lee, & Park, 2022)

***Releases Endorphins*** (Özer & Ateş, 2021)

***Reduces GI symptoms of IBS*** (Tavakoli et al., 2019)

***Increases Motor Function, Balance, and Flexibility*** (Akram, Nader, & Ahmad, 2013)

**Research Profiles of Laughter Therapies/Yoga (Psychosocial Outcomes)**

The profile of *psychosocial research* portrays an entirely different image (Table 4). While the limitations of study designs are the same, the outcome variables take the forms of tests, scales, and questionnaires, not blood and saliva assays and brain imaging. There are 169 studies with the

heaviest concentration on depression, stress, anxiety, pain, and mood. There are fewer on sleep, quality of life, happiness, positive feelings, self-esteem, and life satisfaction, plus one or two studies on other variables. The investigations on a given topic are not comparable in design, intervention, and the diversity of participants and patients with different conditions and diseases. For example, the results of one or two studies with 20 Parkinson's patients do not generalize to other Parkinson's patients or anyone else.

**Table 4: Research Profile of Psychosocial Outcome Effects of Laughter Therapy, Laughter Yoga, and Laughter-Induced Therapy (20 yrs)**

***Decreases Depression*** (Bennett et al., 2015; Bressington et al., 2019; Chae, 2015; Cha, Na, & & Hong, 2012; Cho & Oh, 2011; Demir, 2015; Ellis, Ben-Moshe, & Teshuva, 2017; Funakubo et al., 2022; George & Jacob, 2014; Greene, Morgan, Traywick, & Mingo, 2017; Han, Park, & Park, 2017; Heidari et al., 2020; Hsieh et al., 2015; Joseph & Riaz, 2015; Kheirandish, 2015; Kim, 2010; Kim et al., 2009, 2010; Kim, Kim, & Kim, 2015a; Kim & Lee, 2012; Kiyak & Kocoglu-Tanyer, 2021; Ko & Youn, 2011; Ko, Lee, & Park, 2022; Lee & Eun, 2010; Lee & Ji, 2011; Lee & Sohn, 2010; Lee & Young, 2011; Lee et al., 2013; Park, 2013; Park et al., 2013; Sahai-Srivastava et al., 2014; Sayed & Gandham, 2018; Seo & Chang, 2011; Shahidi et al., 2011; Vijay & Gandam, 2018; Weinberg, Hammond, & Cummins, 2014; Yazdani et al., 2014; Yu & Kim, 2009; Zhao et al., 2019)

***Decreases Anxiety*** (Akimbekov, & Razzaque, 2021; Alici, Bahceli, & Emiroğlu, 2018; Bennett et al., 2015; Bressington et al., 2019; DeFrancisco et al., 2019; Demir, 2015, 2020; Dhivagar, Prabavathy, & Renuka, 2016; Ghodsbin, Sharif, Jahanbin, & Sharif, 2015; Greene, Morgan,

Traywick, & Mingo, 2017; Han et al., 2011; Kim, 2010; Kim & Lee, 2012; Kim et al., 2009; Kim, Kim, & Kim, 2015a; Ko, Lee, & Park, 2022; Kiyak & Kocoglu-Tanyer, 2021; Lee & Sohn, 2010; Memariam, Sanatkaran, & Bahari, 2017; Park et al., 2013; Sayed & Gandham, 2018; Tavakoli et al., 2019; Vijay & Gandam, 2018; Weinberg, Hammond, & Cummins, 2014; Yazdani et al., 2014; You & Choi, 2012; Yu & Kim, 2009; Zhao et al., 2019)

***Decreases Stress*** (Akimbekov, & Razzaque, 2021; Bennett et al., 2015; Bressington et al., 2019; Choi et al., 2010; Demir, 2015; Daisy, 2018; Dhivagar, Prabavathy, & Renuka, 2016; Farifteh, 2014; Funakubo et al., 2022; Kheirandish, 2015; Hur, 2007; Kaur, 2014; Kim & Kim, 2014; Kim & Jun, 2009; Kim et al., 2009; Kim, Kim, & Kim, 2015a; Ko, Lee, & Park, 2022; Lee & Ji, 2011; LeTexier, 2015; McGuire, Laures-Gore, Freestone, & van Leer, 2020; Mi-Youn, & Suk, 2018; Miles, Tait, Schure, & Hollis, 2016; Nagendra et al., 2007; Varghese et al., 2020; Weinberg, Hammond, & Cummins, 2014)

***Increases Pain Tolerance and Discomfort Thresholds*** (Choi et al., 2010; Han, Park, & Park, 2017; Herschenhorn, 1995; Kessler et al., 2010, 2012; Kim & Kim, 2014; Kim et al., 2010; Ko & Huyn, 2016; Ko & Youn, 2011; Lee & Eun, 2010; Özer & Ateş, 2021; Pérez-Aranda et al., 2019; Shahabizade et al., 2017; Tse et al., 2010; Yang, 2008; You & Choi, 2012; Yu & Kim, 2009)

***Improves Mood*** (Bennett et al., 2015; Choi et al., 2010; DeCaro & Brown, 2016; Dolgoff-Kaspar et al., 2012; Ellis, Ben-Moshe, & Teshuva, 2017; Han et al., 2011; Heo, Kim, Park, & Kil, 2016; Hur, 2007; Kim et al., 2015b; Miles, Tait, Schure, & Hollis, 2016; Song, Park, & Park, 2011, 2013; Weinberg, Hammond, & Cummins, 2014; Zhao et al., 2019)

***Improves Sleep and Decrease Insomnia*** (Ghodsbin, Sharif, Jahanbin, & Sharif, 2015; Han, Park, & Park, 2017; Jung et al., 2009; Ko & Youn, 2011; Lee & Eun, 2010; Lee & Young, 2011;

Memariam, Sanatkaran, & Bahari, 2017; Park, 2013; Salunke, & Shah, 2019; Seo & Chang, 2011)

***Improves Quality of life*** (Bennett et al., 2015; Cho & Oh, 2011; Demir, 2015; Funakubo et al., 2022; Heidari et al., 2020; Heo, Kim, Park, & Kil, 2016; Hur, 2007; Ko & Youn, 2011; Kuru & Kublay, 2017; Lee et al., 2013; Morishima et al., 2019; Rezaei et al., 2019; Shahidi et al., 2011)

***Increases Self-esteem*** (Bennett et al., 2015; Cha, Na, & & Hong, 2012; DeFrancisco et al, 2019; Kim, 2010; Kim et al., 2015b; Lee & Young, 2011; Ozturk & Acikgoz, 2022; Seo & Chang, 2011)

***Increases Happiness*** (Bayat, Jafari, & Behboodi, 2013; Bennett et al., 2015; DeFrancisco et al, 2019; Ellis, Ben-Moshe, & Teshuva, 2017; Greene, Morgan, Traywick, & Mingo, 2017; Ozturk & Acikgoz, 2022; Tse et al., 2011)

***Improves Life Satisfaction*** (Shahidi et al., 2011; Song, Park, & Park, 2011, 2013; Weinberg, Hammond, & Cummins, 2014)

***Increases Positive Feelings and Mindset*** (Beckman, Regier, & Young, 2007; Dolgoff-Kaspar et al., 2012; Hatzipapas, Visser, & Rensburg, 2017)

***Increases Self-efficacy for Exercise*** (Greene, Morgan, Traywick, & Mingo, 2017; Shahabizade et al., 2017)

***Enhances Mental Functioning/Cognition*** (Greene, Morgan, Traywick, & Mingo, 2017; Ko, & Youn, 2011)

***Improves Subjective Well-being*** (DeCaro & Brown, 2016; Funakubo et al., 2022; Tremayne & Sharma, 2019 2Weinberg, Hammond, & Cummins, 2014)

***Decreases Loneliness*** (Alici, Bahceli, & Emiroğlu, 2018; Bayat, Jafari, & Behboodi, 2013)

***Decreases Aggression*** (Kheirandish, 2015)

***Decreases Frustration*** (Kheirandish, 2015)

***Decreases Anger*** (Lee & Sohn, 2010)

***Decreases Fatigue*** (Shin, Ryu, & Song, 2011)

***Improves Social Relationships*** (Hatzipapas, Visser, & Rensburg, 2017)

***Improves Coping Skills*** (Hatzipapas, Visser, & Rensburg, 2017)

***Increases Hope*** (Shahabizade et al., 2017)

## Conclusion and Preview of Part 2

As you are still processing the form and substance of the studies just reviewed, what can be added in the final installment to this two-parter? This part will summarize the possible harmful effects of spontaneous laughter, scrutinize the quality and quantity of laughter research, deduce the major conclusions from the outcomes of this review, suggest directions for future research, and acknowledge the limitations of this work.

Unlike most previous reviews, special attention will be given to the methodological weaknesses that characterize the studies within the categories of outcome benefits. Four weaknesses will be addressed: (1) sampling, (2) interventions, (3) research design, and (4) outcome measures. With all that has been written on the topic of laughter, it is hoped that this synthesis of the research will contribute something new to our understanding to guide current practices and pinpoint areas for improvement and future research.

## References [3]

[3] **Editorial Note**: Given the nature of the research, the reference list adds almost 50 pages to this article. **Kindly contact the author directly to receive a full or partial list.**