

The Effect of Laughter on Stress and Natural Killer Cell Activity

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Abstract

Aim: To find out the effect of laughter on stress and natural killer cell activity.

Background and reason: Stress is a well-known slow killer, is rampant in our society, which impact everyone differently, but the final results are easy to observe and explain. Laughter triggers the release of a cocktail of happy chemicals, including NK cells, endorphins, serotonin, and growth hormone that are produced each time we laugh that boosts the immune responses. Laughter stimulates circulation and helps muscle relaxation which is releasing stress. Effect of laughter on stress and natural killer cells are to be reviewed as laughter significantly can reduce stress as well as improve the natural killer cells activity. Thorough literature research performed with present inclusion and exclusion criteria.

Keywords: stress, natural killer cells, endorphins, apoptosis, enzymes

INTRODUCTION

Laughter is the best way to reduce stress in people live, and can aid us to deal and survive a stressful lifestyle.

Since 20 years ago, it is frequently documented by psycho-neuro-immunological (PNI) research related to different types of stressors which lead to interactions among the neurological, endocrine, and immune systems that results in decrease of immune functioning and resistance towards disease (1-3). The research is however limited as to the interventions that are highly effective modify the effects of immune function stress. Instead, few interventions has been carried out and being published to the people without their effectiveness and action mechanisms data.

Many individuals have contributed to the modern therapeutic laughter history. In 1979, Norman Cousins, celebrated political writer published a book Anatomy of an Illness. In his book, he described a possible fatal disease he contracted in 1964. He discovered the advantages of humor and other positive emotions in fighting the disease. He found that a 10 minutes of mirthful laughter provided him two hours of pain-free sleep (4). His discovery baffled the science community and have encouraged a numerous of research projects afterwards.

In late 1960s, Dr. William F. Fry, a psychiatrist of Stanford University, California, started to examine the physiological effects of laughter. Due to this, he was well known as the father of 'gelotology' (the laughter science). He managed to prove that mirthful laughter gives good physical exercise and able to reduce the possible of respiratory infections. Dr. Fry has proven that endorphins which are natural painkillers is produced by the body when people laugh (5).

Dr. Lee Berk from Loma Linda University Medical Centre and his researcher team from the psycho-neuro-immunology (PNI) field began to study the mirthful laughter physical impact after getting inspired by Norman

Cousins. In a study, a group of heart attack patients were separated into two smaller groups; the first group was situated under standard medical care whereas the second group watched humorous video for about 30 minutes per day. After a year, there were fewer arrhythmias in the 'humor' group, and thus needed lesser medication doses. The other group had two and a half times more recurrent heart attack compared to the humor group (50% vs. 20%) (6).

Dr. Annette Goodheart is a psychotherapist and she invented laughter therapy and laughter coaching. She has been using laughter to cure cancer, AIDS, depression and other diseases for 36 years (7).

Dr. Madan Kataria, a Mumbai, India medical doctor was writing an article Laughter-The Best Medicine for a health journal in March 1995. Particularly, he was impressed by the book Anatomy of an Illness written by Norman Cousins in 1979 and also the research done by Dr. Berk. Dr. Kataria found that our body cannot distinguish between acted and genuine laughter. Therefore, he created a several of laughter exercises including the role-play elements and other techniques. He is known as a creator of Laughter Yoga (8).

In September 2011, a research demonstrating that non-stop laughter significantly enhances people's pain threshold up to 10% was published by the academics from Oxford University (9).

Thus this review is done to find out the effect of laughter on both stress and NK cells activity.

How laugh can be beneficial?

Based on the survey done on the cancer patients of rural Midwestern, almost 90% of the respondents were using minimum one complementary or additional intervention together with main field medical care (10). Prayer is the major intervention recorded followed by humor. Half of the respondents were currently using humor-intervention,

and slightly more than 10% are considering to use the method (10). According to both local women and men cancer patients, the former prefer to use humor in comparison to latter (10).

Humour is one of the well-known cognitive-behavioural interventions. However, more studies are required to show its efficiency in this field (11, 12). It has been shown that humor can be used to reduce stress, relieve pain or as an adjuvant (a substance that enhances the immune responses of body towards antigen) therapy to increase the life quality (13-15). Studies done by Bennet et al (16) illustrates the role of laughter as mood enhancer, psychological measures of stress reducer, and also acts in the reduction of perception of pain. Release of psychological tension, that acts as a buffer of stressful events on affect is involved in the mechanisms that underlie these effects.

It is also possible that physiological factors are involved in reducing stress. For instance, laughter can cause the alters in heart rate, temperature of the skin, blood pressure, pulmonary ventilation, skeletal muscle and brain activity, all of which may result in the improvement of overall well-being (17).

The prevention of production of stress hormone such as cortisol by laughter (18) may improve immune function (19). Laughter increases the secretion of immune-enhancers such as beta-endorphin which also improve the immune function (20-21).

Health may be influenced by the humor, as reported by PNI theory (22) and several humor studies (23), via the stress chemicals and immune enhancement moderation (24).

Increased levels of salivary immunoglobulin A (IgA) is an evidence of the exposure to a humorous stimulus (25). However, few investigators against the use of IgA as a measure of immune function due to differences in an individual salivary flow rate and the application of stimulated and non-stimulated samples in various studies (26, 27).

Therefore, natural killer, NK cell activity was used in this study instead of IgA as the immune function measure as it assays shows the clearest result in this research field (1, 28).

What is a NK Cell?

A natural killer (NK) cell is a part of the body's immune system and is involving in destroying tumor cells or cells that are infected by viruses. It can kill body's own cells, thus NK cell activity is carefully regulated by the immune system. It does not usually attack healthy cells and able to recognize and target infected and cancerous cells.

It is a lymphocyte type or a white blood cell. It is part of the innate immune system rather than the adaptive immune system and produced by the bone marrow. Adaptive immune system generates a particular response to a precise type or strain of infecting organism whereas the innate immune system reacts to non-specific threats by attacking cells that it does not recognize as healthy human cells. It can be involving pathogens, such as harmful bacteria, or they may be human cells that cannot function

normally due to infection or mutation. Innate immune system otherwise known as first line of defence (29).

The NK cell has two types of receptors, activating and inhibiting receptors. Activating receptor are those that stimulates the NK cell to destroy a cell when it binds to any one of various molecules present on that cell's surface whilst inhibiting receptor are those that overrides the "kill" signal when it binds to a molecule called major histocompatibility complex I (MHC-I) that present on the surface of a normal cell. NK cells are not able to receive the inhibiting signal in case of cells that are cancerous or that are infected with a virus as they are not able to produce MHC-I, thus likely kill the cell (29).

Natural killer cells kill an infected or cancerous cell by releasing two types of chemicals. It begins with release of perforins, that create small spores on the cell's surface. An enzyme known as granzymes will pass through these pores into cell, which further stimulate the release of other enzymes. These enzymes kill the cell by a process called apoptosis, a programmed cell death. In apoptosis, the cells undergo shrinking and form fragments in which each fragment limited with membrane. As the cell dies, this membrane prevent the release of viruses or harmful substances and later distinguished by the involved immune system which is phagocytes. Cytokines and chemokines, the other two types of chemicals involved in the activation of the adaptive immune_response to infection and other threats (29).

How NK cell activity affected by laugh?

Natural killer cells has an important role in the host-rejection of both tumors and infected cells that easily spread. They are cytotoxic, have cytoplasm which reside special proteins known as perforin and proteases, called as granzymes. Perforin, as it releases close to a cell slated for killing, it produces pores. The formed pores in the target cell membrane allow the entering of granzymes and other molecules, thus inducing apoptosis. Apoptosis can cause destruction of virus. The activation of NK cells are due to response of interferon. The immune response is adapted and clear the infection as it contains viral infection by releasing antigen-specific cytotoxic T cells (30). Thus, people with less or scant NK cells susceptible to herpes virus infection.

By laughing, the subjects showed the reduction of glucocorticoids levels. The glucocorticoids, as its level elevates, have shown that it could reduce the NK cell activity (31). Glucocorticoids is believable can affect the activity of NK cell. Furthermore, laughter reduce the levels of both epinephrine and norepinephrine, indicating lower stress levels (5).

There were four evidences shown that humorous stimulus could affect NK cell activity. Overall, all evidences showed that NK cell activity reduced significantly after watching. In the studies, all participants' blood samples were taken and examined before and after watching the humorous and distressing videos. As expected, NK cell activity were decreased to those who watched humorous video in comparison to those who watched distressing video, which NK cell activity elevated (31).

Use of Humor as a Complementary Intervention to Reduce Stress

In the study done by Bennet et al (10) indicate that exposure to a humorous stimulus can considerably reduce self-reported stress levels. Increased mirthful laughter, as measured on the HRS, correlated with reduction in stress scores following the humorous video. The stress reduction following mirthful laughter found in this study is supported by other findings. A study of dental patients and stress found that patients who joked and laughed prior to dental surgery reported with less psychological stress (32). A study of the effects of mirthful laughter on physiological measures of stress found that cortisol decreased more quickly in persons who laughed compared with persons in the control group (33).

As evidenced by this study, it appears that a momentary period of mirthful laughter may reduce psychological and physiological measures of stress for an uncertain amount of time.

Stress and Immune Function

Less positive change in NK cell activity is determined in relation to higher levels of both preintervention stress and postintervention stress. People who were much stressed may not have been able to respond positively to either the interruption or watching the humorous video. Higher levels of cortisol and other stress hormones present in subjects with higher stress levels and several studies have documented the negative relationship between cortisol levels and NK cell activity (34).

CONCLUSION

Humor appeals to both non-healthcare professionals and health-care professionals in a similar manner.

Laugh is believed can make someone feel better, thus can help them to recover. However, more research can be done to prove the effect of laugh or humor on healing. The studies done showed a positive NK cell activity for those having decreased stress levels and vice versa.

Research on the effects of laughter on stress and immune function has been done since 20 years ago. However, the research is still in the early phase. Besides, the evidences that showed laugh affects the NK cell activity were done only on male participants in addition to only small number of participants participated in these researches.

Thus, further investigations should be conducted on various condition, upon healthy and to those whom suffering cancer such as breast cancer in woman.

REFERENCES

- Herbert, Tracy B., and Sheldon Cohen. "Depression and immunity: a meta-analytic review." *Psychological bulletin* 113.3 (1993): 472.
- Solomon, George F. "Psychoneuroimmunologic approaches to research on AIDS." *Annals of the New York Academy of Sciences* 496.1 (1987): 628-636.
- Zeller, Janice M., Nancy L. McCain, and Barbara Swanson. "Psychoneuroimmunology: an emerging framework for nursing research." *Journal of Advanced Nursing* 23.4 (1996): 657-664.
- Cousins, N. (1976). Anatomy of an illness (as perceived by the patient). *New England Journal of Medicine*, 295(26), 1458-1463.
- Berk, L. S., Tan, S. A., Fry, W. F., Napier, B. J., Lee, J. W., Hubbard, R. W., ... & Eby, W. C. (1989). Neuroendocrine and stress hormone changes during mirthful laughter. *The American journal of the medical sciences*, 298(6), 390-396.
- American Physiological Society. (2009, April 17). Laughter Remains Good Medicine. *ScienceDaily*. Retrieved June 4, 2016 from www.sciencedaily.com/releases/2009/04/090417084115.htm
- Dugan, D. O. (1989, January). Laughter and tears: best medicine for stress. In *Nursing forum* (Vol. 24, No. 1, pp. 18-26). Blackwell Publishing Ltd.
- Kataria, M. (2005). Laughter Yoga. *Online: www.laughteryoga.org*.
- Laughter Therapy as Stress Relief. (n.d.). Retrieved May 22, 2016, from <http://www.skillsyouneed.com/ps/therapeutic-laughter.html>
- Bennett M, Lengacher C. Design and testing of the Complementary Therapy Rating Scale. *Altern Health Pract*.1998;4(3):179-198.
- Adams E, McGuire F. Is laughter the best medicine? A study of the effects of humor on perceived pain and affect. *Activ Adapt Aging*. 1986;8(3-4):157-175.
- Hudak D, Dale A, Hudak M, DeGood D. Effects of humorous stimuli and sense of humor on discomfort. *Psychol Rep*. 1991;69(3):779-786.
- Trice A, Price J. Joking under the drill: a validity study of the Coping Humor Scale. *J Soc Beh Pers* . 1986;1(2):265-266.
- White S, Camarena P. Laughter as a stress reducer in small groups. *Humor: Int J Humor,Res*. 1989;2(1):73-79.
- White S, Winzelberg A. Laughter and stress. *Humor: Int J Humor Res*.1992;5(4):343-355.
- Bennett, M. P., Zeller, J. M., Rosenberg, L., & McCann, J. (2003). The effect of mirthful laughter on stress and natural killer cell activity. *Alternative therapies in health and medicine*, 9(2), 38.
- Wooten P. Humor: an antidote for stress. *Holist Nurs Pract*.1996;10(2):49-56.
- MacHovec F. Humor in therapy. *Psychother Priv Prac*. 1991;9(1):25-33.
- Martinez J. The Role of Empathic Humor in Counteracting Burnout and Promoting Renewal: The Development and Implementation of a Personal Growth Workshop. Boston, Mass: University of Massachusetts; 1989.
- Metcalf C. Humor, life, and death. *Oncol Nurs Forum*. 1987;14(4):19-21.
- Sullivan J, Deane D. Humor and health. *J Gerontol Nurs*. 1988;14(1):20-24.
- Berk L, Tan S, Eby B, Carmons M, Vorce D. Modulation of human natural killer cells by catecholamines. *Clin Res*. 1984;32(1):51A.
- Berk L, Tan S, Nehlsen-Cannarella S, et al. Humor associated laughter decreases cortisol and increases spontaneous lymphocyte blastogenesis. *Clin Res*. 1988;36:435A.
- Dillon K, Minchoff B, Baker K. Positive emotional states and enhancement of the immune system. *Int J Psych Med*. 1985;15:13-18.
- Martin R, Dobbins J. Sense of humor, hassles, and immunoglobulin A: evidence for a stress-moderating effect of humor. *Int J Psych Med*. 1988;18(2):93-105.
- Stone A, Cox D, Valdimarsdottir H, Neale J. Secretory IgA as a measure of immunocompetence. *J Human Stress*. 1987;13(3):136-140
- Schulz K, Schulz H. Overview of psychoneuroimmunological stress- and intervention studies in humans with emphasis on the uses of immunological parameters. *Psychooncology*. 1992;1:51-70.
- Natural Killer Cell. (n.d.). Retrieved June 05, 2016, from https://www.sciencedaily.com/terms/natural_killer_cell.htm
- Riddell, P., & Joseph, A. (2019, February 08). What Is a NK Cell? Retrieved from <https://www.wisegeek.com/what-is-a-nk-cell.htm>
- Berk L, Tan S, Napier B, Eby W. Eustress of mirthful laughter modifies natural killer cell activity. *Clin Res*.1989;37:115A.
- Berk L, Tan S, Eby B, Carmons M, Vorce D. Modulation of human natural killer cells by catecholamines. *Clin Res*. 1984;32(1):51A.
- Trice A, Price J. Joking under the drill: a validity study of the Coping Humor Scale. *J Soc Beh Pers* .1986;1(2):265-266.
- Berk L, Tan S, Fry W, et al. Neuroendocrine and stress hormone changes during mirthful laughter. *Am J Med Sci*.1989;298(6):391-396
- Caudell K, Gallucci B. Neuroendocrine and immunological responses of women to stress. *West J Nurs Res*. 1995;17(6):672-92.