

THE INHIBITORY EFFECT OF LAUGHTER YOGA ON THE INCREASE IN POSTPRANDIAL BLOOD GLUCOSE IN TYPE 2 DIABETIC PATIENTS

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postprandial blood glucose,
type 2 diabetes,
laughter yoga*

SUMMARY

The aim of the present study was to determine the impact of laughter therapy on the blood glucose level in type 2 diabetic patients. For this purpose, we used laughter yoga, which includes respiratory laughing and fun exercises. The study involved 211 participants, of which 110 were involved and 101 were not involved (control group) in laughter yoga. In both groups, the level of blood glucose was measured at arrival after they had standard brunch, a total of 250 Kcal. A 90-minute lecture was followed by 30-minute intense workout for those participants who had laughter yoga included in the program. In both groups, the level of blood glucose was measured after 120 minutes. We found the inhibitory effect of laughter on the increase in postprandial blood glucose ($P < 0.05$). Our study indicated the importance of daily opportunities for laughter in patients with diabetes.

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INTRODUCTION

Diabetes mellitus is associated with considerable morbidity and mortality in the elderly and is the most prevalent metabolic disease and one of the significant medical and socioeconomic problems all over the world. It is a chronic disease, which needs long clinical observation and constant adherence to medication. Negative emotions such as anxiety, fear and sorrow are known to be factors that elevate the blood glucose level (1). Conversely, positive emotions such as laughter have been reported to modify the levels of neuroendocrine factors involved in negative emotions and to modulate immune function (2-4). In 1995, the Indian cardiologist Madan Kataria decided to bring laughter to the humanity as close as possible. He founded the Laughter Yoga School.

A study of the influence of laughter on the blood glucose level in diabetic patients was published in 2003 (5). The study found a significantly reduced increase of sugar levels after meal. The cause could be the muscular work because of laughter. Counter regulatory hormones or neuroendocrine system (4) could also be the cause. Laughter yoga was also beneficial as exercises in elderly depressed women (6). The group, which practiced laughter yoga twice a week for twelve weeks, showed lowering of blood

pressure, fat reduction and regulation of the blood glucose level. Therefore, laughter yoga is recommended for diabetics to improve their long-term regulation of glucose (7). A long-term study also found hormonal and genetic changes that had a favorable effect on blood glucose levels (8,9). Humor also has a positive effect in post-stroke rehabilitation (10).

Our study elucidated the inhibitory effect of laughter yoga on the increase in postprandial blood glucose and suggested the importance of daily opportunities for laughter in patients with diabetes. The results obtained indicated that in the future, laughter therapy could be used as a new nonpharmacological approach for improving glycemic control in patients with type 2 diabetes.

MATERIALS AND METHODS

Study participants

This randomized controlled study involved 211 participants with type 2 diabetes not receiving insulin therapy. They were referred to the Department of Internal Medicine, Section of Endocrinology, University Clinical Centre Maribor, because of the newly discovered diabetes. Of them, 110 were involved in laughter yoga and 101 were not included (control group). Both groups were subdivided into those taking medicines for hyperglycemia reduction and those not taking these medicines (Table 1). An informed consent was obtained from all participating individuals and ethics approval was granted prior to conducting the study.

Study design and protocol

On experimental day, we measured the level of blood glucose at arrival (fasting blood glucose, FBG), then the participants ate the same 250 Kcal meal (30 g brown bread (1 food unit, FU), 150 g apples (1 FU), 15 g of butter (2.5 FU) and 200 mL of unsweetened tea). A 90-minute lecture was followed by 30-minute intense workout for those with laughter yoga included in the program. The level of blood glucose was then measured upon completion of the workout (120 min)

(2-h postprandial blood glucose, PPBG). Control subjects listened to a lecture instead of 30-minute laughter yoga. In this group, PPBG was also measured after the lecture (120 min). Blood glucose was measured from the fingertip by enzyme colorimetric assay using a blood glucose self-measurement apparatus.

For the purpose of this study, we created a nine-tiered questionnaire about the influence of laughter yoga on the well-being of participants. Enthusiasm, positive attitude, better breathing, energy level, mood, ability to laugh for no reason, optimism, stress level, physical and mental relaxation were assessed only by the participants included in the laughter yoga program, led by a certified laughter yoga teacher. The laughter yoga program included clapping, walking, laughing, stretching and breathing exercises. Their well-being was evaluated before and after 30-minute program using a 1-10 scale (1 indicating minimum and 10 maximum).

Statistics

Statistical analysis was performed with the VasserStats software. For various means of FBG and 2-h PPBG, odds ratio (OR) and 95% confidence interval (CI) were calculated. Differences between the experimental group and control group were assessed by the t-test.

Figure 1. Overall well-being of participants involved in laughter yoga: assessment of well-being before and after laughter yoga.

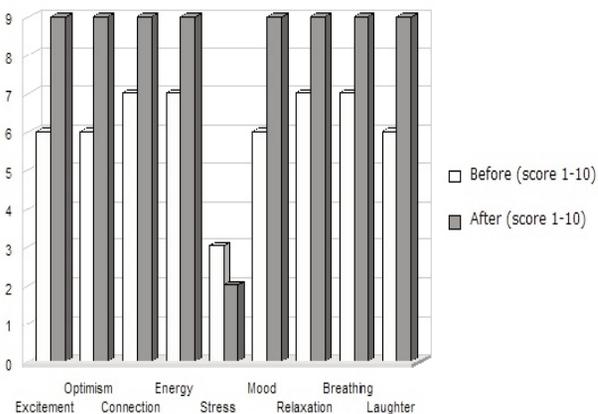


Table 1. Number of participants divided into those taking and not taking medicines for hyperglycemia reduction

	Number of participants	
	Laughter yoga	Without laughter yoga (controls)
Without medicines	44	40
With medicines	66	61
Σ	110	101

Table 2. Mean blood glucose levels before and after exercise, and statistical significance

	Mean blood glucose level (mmol/L)				Control-based	
	At arrival		After 120 min		odds ratio (95% CI); P-value*	
	Laughter yoga	Without laughter yoga	Laughter yoga	Without laughter yoga	Laughter yoga	Without laughter yoga
Without medicines	9.60	8.29	7.92	9.82	1.68±0.60; <0.001	-1.53±0.55; 0.001
With medicines	9.87	8.39	8.38	10.19	1.49±0.34; <0.001	-1.80±0.46; <0.001
Σ	9.75	8.35	8.19	10.04	1.57±0.31; <0.001	-1.69±0.35; <0.001

P-value*, t-test

Table 3. Mean levels of fasting blood glucose (FBG) with statistical significance

	Mean FBG (mmol/L)		Control-based
	Laughter yoga	Without laughter yoga	odds ratio (95% CI); P-value*
Without medicines	9.25	8.98	0.27±1.51; 0.720
With medicines	8.65	8.90	0.12±1.14; 0.834
Σ	8.97	8.93	0.04±0.91; 0.936

P-value*, t-test

Table 4. Mean levels of 2-h postprandial blood glucose (PPBG) with statistical significance

	Mean 2-h PPBG (mmol/L)		Control-based
	Laughter yoga	Without laughter yoga	odds ratio (95% CI); P-value*
Without medicines	8.34	10.05	1.71±0.81; <0.001
With medicines	8.66	9.78	1.12±1.03; 0.03
Σ	8.53	9.88	1.35±0.81; 0.001

P-value*, t-test

RESULTS

Results of the study are presented in Tables 1-4 and Figure 1. Table 1 presents the number of participants divided into those taking medicines for hyperglycemia reduction (n=127) and those not taking these medicines (n=84). Of them, 110 (66 with medicines and 44 without medicines) had laughter yoga included in the program. The remaining 101 (61 with medicines and 40 without medicines) participants only listened to a lecture.

The mean levels of FBG and 2-h PPBG with statistical significance are presented in Table 2. The 30-minute workout had a favorable influence on all study parameters and also reduced the postprandial increase in the blood glucose level from 9.75 to 8.19 mmol/L ($P<0.001$). In the control group, 2-h PPBG increased from 8.35 to 10.04 mmol/L ($P<0.001$). Table 3 shows the mean levels of FBG with statistical significance and Table 4 the mean levels of 2-h PPBG with statistical significance. The mean level of FBG was not statistically significantly different between the

two groups (8.97 mmol/L and 8.93 mmol/L; $P=0.936$) (Table 3). After the meal, control participants had a statistically significantly higher level of blood glucose (9.88 mmol/L) than those exposed to laughter yoga workout (8.53 mmol/L; $P=0.001$) (Table 4).

Overall well-being of the participants before and after laughter yoga is illustrated in Figure 1. The questionnaire on well-being revealed strong effects on well-being, in particular on the feeling of stress, which decreased after laughter yoga.

DISCUSSION

In the present study, we found that a 30-minute intense laughter yoga workout significantly reduced the level of blood glucose in people with type 2 diabetes immediately after exercise, irrespective of whether or not using drugs to treat type 2 diabetes. At the same time, we found that laughter yoga had a favorable impact on the well-being of the individuals as it improved enthusiasm, positive attitude, breathing, energy level, mood, ability to laugh for no reason, optimism, stress level, and physical and mental relaxation. In particular, we point out that the feeling of stress decreased substantially after laughter yoga. There is no doubt that laughter yoga improved well-being of the individual and reduce the feeling of stress regardless of whether or not using antidiabetic drugs.

A study published in 2003 found that laughter significantly reduced the increase of blood glucose levels after meal. The authors concluded that the reason could be in the muscular work because of laughter (5). Shahidi *et al.* published a case study of elderly depressed women where laughter yoga proved very useful for solving the problems with negative emotions caused by depression (6). Other authors found hormonal and genetic changes associated with laughter, which had a positive effect on blood glucose levels (4,8,9).

However, there have been no studies on the effects of laughter yoga on PPBG. Hayashi *et al.* have published results suggesting a significant reduction of the increase in PPBG by watching comedy in patients with diabetes (5,8,9). We consider that laughter yoga is

better choice than watching comedies due to the additional presence of intense yoga breathing and movement. Undisputed regular exercise improves metabolism, blood glucose levels, blood pressure, blood fat and helps in maintaining appropriate body weight, which is very important in the treatment of people with type 2 diabetes.

Numerous facts indicate that in the future, laughter therapy as laughter yoga could be used as a new nonpharmacological approach for improving glycemic control in people with type 2 diabetes.

CONCLUSION

Laughter yoga has proved to be an effective complementary and preventive therapy in reducing postprandial levels of blood glucose. Therefore, it contributes to long-term regulation of type 2 diabetes. Laughter is of preventive, psychological, physiological and therapeutic importance. However, it must be dealt by professionals (11,12). On the other hand, we know that stress is one of the major risk factors for cardiovascular disease. Actually, in our study, participants showed by the questionnaire that laughter yoga is an effective method to enhance positive mindset and effective tool of relaxation and networking among people. Given the fact that laughter yoga is a simple and effective method, which bypasses all intellectual systems and leads people to laugh, it could be used as nonpharmacological treatment in preventing chronic microvascular complications of type 2 diabetes.

REFERENCES

1. Surwit RS, Schneider MS. Role of stress in the aetiology and treatment of diabetes mellitus. *Psychosom Med* 1993;55:380-393.
2. Berk LS, Tan SA, Fry WF, Napier BJ, Lee JW, Hubbard RW, Lewis JE, Eby WC. Neuroendocrine and stress hormone changes during mirthful laughter. *Am J Med Sci* 1989;298:390-396.
3. Berk LS, Tan SA, Napier BJ, Eby WC. Eustress of mirthful laughter modifies natural killer cell activity. *Clin Res* 1989;37:115. (Abstract)
4. Takahashi K, Iwase M, Yamashita K, Tatsumoto Y, Ue H, Kuratsune H, Shimizu A, Takeda M. The elevation of natural killer cell activity induced by laughter in a crossover designed study. *Int J Mol Med* 2001;8:645-650.
5. Hayashi K, Hayashi T, Shizuko I, Koichi K, Hitoshi I, Shin'ichi S, Kazuo M. Laughter lowered the increase in postprandial blood glucose. *Diabetes Care* 2003;26(5):1651-1652.
6. Shahidi M, Mojtahed A, Modabbernia A, Mojtahed M, Shafiabady A, Delavar A. Honari laughter yoga *versus* group exercise program in elderly depressed women: a randomized controlled trial. *Int J Geriatr Psychiatry* 2011;26(3):322-327.
7. Murrock CJ, Higgins PA, Killion C. Dance and peer support to improve diabetes outcomes in African American women. *Diabetes Educ* 2009;35(6):995-1003.
8. Hayashi T, Murakami K. The effects of laughter on postprandial glucose levels and gene expression in type 2 diabetic patients. *Life Sci* 2009;85(5-6):185187.
9. Hayashi T, Tsujii S, Iburi T, Tamanaha T, Yamagami K, Ishibashi R, Hori M, Sakamoto S, Ishii H, Murakami K. Laughter up-regulates the genes related to NK cell activity in diabetes. *Biomed Res* 2007;28(6):281-285.
10. Tan SA, Tan LG, Lukman ST, Berk LS. Humor, as an adjunct therapy in cardiac rehabilitation, attenuates catecholamines and myocardial infarction recurrence. *Adv Mind Body Med* 2007;22(3-4):8-12.
11. Mora-Ripoll R. Potential health benefits of simulated laughter: a narrative review of the literature and recommendations for future research. *Complement Ther Med* 2011;19(3):170-177.
12. Mora-Ripoll R. The therapeutic value of laughter in medicine. *Altern Ther Health Med* 2010;16(6):56-64.