

## The effect of Swedish massage on fasting glucose levels, insulin resistance, cortisol, adrenaline and heart rate in women with type II diabetes

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### ABSTRACT

The aim of this study was to evaluate the effect of Swedish massage on some physiological factors in women with type II diabetes. The experimental group included 12 women with type II diabetes and also had 12 patients with type II diabetes in the control group. The subjects received Swedish massage for four weeks (three sessions a week) in the back and in the abdomen respectively for 10 and 20 minutes. The blood samples were collected 24 hours before the first session of massage and 24 hours after the last session and the changes of factors were measured at rest, as well as the mean blood pressure and resting heart rate before and 24 hours after the first massage session of massage. Independent and dependent T-test was used to analyze the data. Results of the study did not show any statistically significant changes in fasting blood glucose levels and insulin resistance in experimental and control groups. Cortisol, adrenaline and heart rate changes were significant in experimental group ( $p < 0/05$ ) but not statistically significant in the control group. All factors were non-significant from the perspective of between-group changes. Overall, this paper showed that massage as an external factor did not have significant impact on the physiological factors affecting diabetes, it can only have positive effects on the heart rate and stress factors, which means massage can be helpful as a relaxing factor.

**KEY WORDS:** SWEDISH MASSAGE, PHYSIOLOGICAL FACTORS, DIABETES TYPE II

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## INTRODUCTION

Diabetes is a common diseases in Iran and worldwide. This chronic disease is progressive and costly, and is considered as a public health problem and creates numerous complications (Eslami, 2010; Mousavi, 2008). Type II diabetes is a complex metabolic and endocrine disorder in which the interaction between multiple genetic and environmental factors causes a variation of insulin resistance and dysfunction of beta cells in pancreas and ultimately leads to diabetes (Heidari Safa, 2011). Massage involves a series of movements and manual skills that are applied regularly on human body tissues to affect neuromuscular system and the general circulation (Baumgart *et al.* 2011). Massage can be effective in the balance of nervous system and the correction of physical balance (Bucher, 2002).

Diabetes is a source of tension for people, and has negative psychological effects other than physical ones, and thus, these make the treatment and the control of the disease so difficult for them and has destructive effects on their quality of life (Moghaddasian and Ebrahimi, 2008). According to the importance of moderating blood pressure in people with type II diabetes, and despite the scientific evidences on the effects of massage, only a few studies have specifically examined the long-term effects of massage on mean blood pressure. These studies give different results on the effectiveness (Williams and Hopper, 1999; Ignatviciuce and Workman, 2006; Aourell *et al.* 2005) or ineffectiveness (National Institute of Diabetes and Digestive Kidney Diseases, 2010) of massages on the blood pressure.

Considering the importance of moderating blood sugar levels as well as regulating the amount of stress hormones, especially cortisol and adrenaline in diabetics, and considering the importance of the role of women in society, the question is that whether Swedish massage in women with type II diabetes can cause changes in physiological indicators such as heart rate, insulin resistance, as well as changes in hematological parameters such as glucose, cortisol and adrenaline.

## MATERIALS AND METHODS

This study has a quasi-experimental design in which the preliminary test (pre-test) and final (post-test) were conducted in two experimental and control groups.

### PARTICIPANTS

Statistical population of the research includes 50 old women with the range of 40-45 years old with diabetes type 2. Among the candidates, 24 people randomly divided into two equal groups that comprised massage group and a control group.

### INCLUSION CRITERIA

- Having at least one year from history of the disease.
- All participants used the same drug conditions
- Having files at Neyshabur Diabetes Prevention Association.
- Non-Smokers
- Having no history of regular physical activity at least for the last six months.
- The scope of their blood sugar levels be between 150 to 250 mg per dl.

### EXCLUSION CRITERIA

- Patients with diabetes type I
- People with special diseases
- People with hyperlipidemia and hypertension
- People with complications of diabetes (neuropathy, nephropathy, retinopathy)
- Lack of regular participation in physical activity

## METHOD

From 50 people who had been referred to the Neyshabur Diabetes Clinic, 24 patients who had the conditions of research selected and randomly divided into two groups: experimental (n = 12) and control (n = 12). The experimental group received Swedish massage for four weeks, which were included three sessions per week, each session lasting 30 minutes. In this period, the control group did not perform any particular physical activity.

### SWEDISH MESSAGES PROTOCOL

Swedish massage in every session consist of 10 minutes of massage in the back and 20 minutes in the abdomen. This is performed with effleurage (string), petrissage (rubbing) percussion (impact), and vibration movements. Effleurage is a slipping movement performed in the hands to improve blood circulation. Petrissage is performed to improve blood and lymph circulation. In petrissage the muscular mass is put up and is rotated or compressed slowly. In the percussion movement, throbbing movements which are light and fast and continuous are performed by the edges of the hands or by palms to the muscles. Vibration is performed by vibrating the tips of fingers or by palms. The aim of the vibration gesture is to help calm the muscles and increase blood circulation is localized.

### BLOOD SAMPLING AND MEASURING THE FACTORS

Blood samples were collected 24 hours before the first massage session and 24 hours after the last session, while the subjects had been fasting for 12Hours. Glucose test was done using enzymatic colorimetric by biosystem's kit.

Table 1. Profile of subjects in two experimental and control groups

Group	Count	Age (y)	Height (cm)	Weight (kg)
Experimental	12	51±5/15	161/38±7/92	71/3±11/77
Control	12	51±4/16	157/26±6/74	71/7±9/03

Insulin resistance was calculated by the homeostasis assessment of insulin resistance (HOMA-IR) according to the following formula.

$$\text{HOMA-IR} = \{[\text{fasting insulin } (\mu\text{U} / \text{ml})] \times [\text{fasting glucose (mmol / l)}]\} / 22.5.$$

Cortisol was evaluated by Vidas-Rosch kit and immunofluorescence method, by the Vidas mini blue machine which is made in France, and Adrenaline was evaluated using adrenaline ELISA kit LDN LABER DIAGOSTIKA and Elisa method by ELISA reader machine version stat fax 303 made in Germany.

### STATISTICAL ANALYSIS

For survey the effect of massage on selected factors on each factor, dependent t test was used and to compare

pretest and post-test data means in each group, the statistical independent t test was used. All the statistical tests were performed at the 95 percent confidence level ( $p < 0.05$ ).

### RESEARCH FINDINGS

In Table 1, descriptive information of the participants of the two groups has been shown.

In Table 2 the results of paired t-test for intergroup changes during the four-week are presented.

As Table 2 shows, a course of massage can cause significant changes in cortisol, adrenaline and heart rate in the experimental group. It means twelve sessions of massage can have a positive impact on mentioned factors. While in control group, who did not receive

Table 2. Results of paired t-test variables measured in two groups.

Group	Variable	Test	M±SD	t	Value
Experimental	Glucose (mmol/L)	Pre- test	136/92±30/69	-2/14	0/056
		Post- test	145/75±32/4		
	Insulin Resistance	Pre- test	3/87±2/38	-0/78	0/44
		Post- test	3/56±1/47		
	Cortisol (mcg)	Pre- test	184/5±63/93	-2/34	0/03*
		Post- test	154/5±54/08		
	Adrenaline (ACTH)	Pre- test	0/27±0/15	-3/24	0/008*
		Post- test	0/14±0/09		
Heart Rate (bpm)	Pre- test	83/91±7/22	-2/21	0/04*	
	Post- test	80±7/03			
Control	Glucose (mmol/L)	Pre- test	141/92±2894	0/48	0/63
		Post- test	146/08±36/37		
	Insulin Resistance	Pre- test	4/37±3/41	-1/26	0/23
		Post- test	3/86±2/98		
	Cortisol (mcg)	Pre- test	166/08±64/16	2/05	0/06
		Post- test	193/42±53/78		
	Adrenaline (ACTH)	Pre- test	0/28±0/18	0/36	0/72
		Post- test	0/3±0/17		
Heart Rate (bpm)	Pre- test	83/25±7/56	0/2	0/84	
	Post- test	83/41±5/83			

\* Significance level ( $p < 0.05$ )

Variable	Group	Means variations	t	Value
Glucose (mmol/L)	Experimental	8/83	0/49	0/37
	Control	4/16		
Insulin Resistance	Experimental	-0/3	0/36	0/88
	Control	-0/51		
Cortisol (mcg)	Experimental	-30	-3/1	0/75
	Control	27/33		
Adrenaline (ACTH)	Experimental	-0/31	-2/05	0/29
	Control	0/23		
Heart Rate (bpm)	Experimental	-3/66	-2/06	0/16
	Control	0/16		

any massage, none of the factors showed significant changes.

As in Table 3, independent t-test results show that no significant differences were obtained comparing experimental and control groups in effectiveness of one session Swedish massage on aforementioned factors. In other words, people with diabetes who have been receiving Swedish massage did not show any statistical significances compared to people who did not.

## DISCUSSION AND CONCLUSION

The results of this study showed significant reduction in cortisol, adrenaline and heart rate in women with type II diabetes in the experimental group after 12 sessions of massage ( $p < 0/05$ ).

However, according to the between-group results, no statistically significant decline was observed in experimental group compared to the control group. The results of cortisol levels, were consistent with the results of the research performed by Christopher Moyer (2004), but were conflicted with the results of studies performed by Sicree (2010), French *et al* (2010) and Anderson and colleagues (2001).

As mentioned about the relationship between stress and diabetes, one of the most important psychological factors influencing diabetes is stress. Scientists have different comments about the relationship between stress and diabetes; The reaction of the organism when faced

an unusual disorder is an over activity of the hypothalamic/pituitary/adrenal axis; In the neuroendocrine system or hypothalamic/pituitary/adrenal cortex axis, stress (such as exams, paragliding, etc.) leads to the release of corticotropin increasing agents by stimulating paraventricular nuclei of hypothalamus. This agent causes synthesis of adrenocorticotropin in the anterior pituitary gland and thus stimulation of adrenal and secretion of glucocorticoids (like cortisol) (Kreyer, 2003). Therefore, stimulating the central sympathetic/adrenal and hypothalamic/pituitary/adrenal cortex axes will result in secretion of catecholamines and glucocorticoids and an increase in heart rate, blood pressure, respiratory rate and metabolism (Goyman and Wingfield, 2004). Massage may alter the activity of the autonomic nervous system (ANS) responses from sympathetic to parasympathetic responses. In this case, cardiovascular activity and stress hormones are reduced and the person feels relaxed and comfortable.

The pressure applied during the therapeutic massage, stimulates the vagus nerve activity, which in turn leads to reduced stress hormones levels and physiological arousal and then parasympathetic response from the ANS (Bjorntorp *et al*. 1999).

The cause of variation with French *et al* (2010) findings, may be due to the small number of massage sessions per week (one session per week) by Vandal. The samples taken by Vandal were urine samples while in this study they were blood samples of participants receiving massage 3 sessions a week. The variation of findings

with Edward *et al* (2010) findings may be due to the presence of both sexes (male and female) and participants' age (45 to 72 years). The results of this study reported a significantly decrease in heart rate of women with type II diabetes in experimental group after 12 massage sessions ( $p < 0/05$ ). However, no statistically significant decline was observed when comparing the results of the two (experimental and control) groups.

These findings are consistent with Zolriasatian and colleagues (2013), Ramezanpour and colleagues (2010), Hassanvand and colleagues (2010), Rahmani Anaraki and colleagues (2001), and Moyer and colleagues (2004) findings. No research was found to be in contrast with the present study findings.

Massage increases blood flow to the arteries, veins, and regional blood flow and stroke volume. It improves lymph drainage and increases serotonin, dopamine and cortisol levels (French, 2010). Therapeutic massage also stimulates the central nervous system parasympathetic tone and reduces the heart rate and respiratory rate and thereby makes one feel relieved (Sarafino, 2002).

## CONCLUSION

12 sessions of Swedish massage in women with type 2 diabetes were unable to cause significant changes in glucose levels and insulin resistance. However, this study showed that massage can be somewhat effective in reducing stress hormones levels such as cortisol and adrenaline, as well as reducing the heart rate at rest.

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