

## **THE BENEFICIAL EFFECTS OF EXERCISE AND YOGA ON DIABETES:**

### **A SURVEY OF MEDICAL RESEARCH**

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Diabetes is a devastating medical condition affecting people of all ages, genders, and nationalities. Diabetics have an inability to bring glucose in from the blood to the cells. This abnormality is due to either a decrease in the production of insulin by the pancreas or an insensitivity of the cells to respond to the insulin present. In either case, the end result is that there is a low level of glucose in the cells and an excess of glucose in the blood stream. It is believed that high glucose levels in the blood lead to vascular damage, resulting in decreased blood flow to all areas of the body. It is this process of diminished blood flow which is responsible for conditions such as diabetic retinopathy (which can cause blindness), neuropathy, kidney failure, urinary difficulties and loss of limbs.

There are two forms of diabetes. Type 1, known as insulin dependent or juvenile diabetes, where almost no insulin is produced, manifests especially in young persons. However, it can also affect the adult under 40 years of age, and occasionally older persons. Very widespread, type 2 diabetes (non-insulin dependent) there is only reduced production, normally attributed to some degenerative process. It manifests especially in persons older than forty who are overweight.

### **MODERN MEDICAL RESEARCH IN THE WEST AND INDIA**

Clinical research in the west has focused exclusively on diabetes as a physical disorder, and hence the treatments that have been researched have involved stimulating the pancreas through drugs, or by controlling the glucose levels by dietary restrictions, artificial insulin, and more recently, by physical exercise. The results of the research on the beneficial effects of exercise will be first surveyed.

Clinical research in India, by contrast, has recognized that diabetes is a psychosomatic disorder, in which the causative factors are sedentary habits, physical, emotional and mental stress and strain. It has studied the beneficial effects of the practice of yoga, which is much more than a physical exercise. Yoga addresses the whole person, considering not only their physical needs, but emotional, mental, intellectual and spiritual needs as well, through gentle movements, relaxation, breathing, lifestyle attitudes and meditation. The results of this research will be surveyed in the second part of this paper.

## **Part I. WESTERN MEDICAL RESEARCH ON THE EFFECT OF PHYSICAL EXERCISE ON DIABETES**

### **Insulin-dependent (Type 1)**

Type 1 diabetes occurs when the pancreas is incapable of secreting sufficient insulin to eliminate the excess of glucose in the blood. Insulin helps to control glycemia, the rate of glucose in the blood, and transforms the excess of glucose (provided by one's food) into fat. Type 1 is more difficult to control than Type 2.

Clinical observations have demonstrated that vigorous physical activity helps diabetic children to better control their level of glucose. (1) Shepard (2) emphasized that in certain studies where the diabetic children were subject to training program, some saw their need for insulin significantly reduced, and others were able to finish diabetic treatment. It is known also that extreme sedentary living, for example, when one is confined to bed, bring a deterioration in the control of glucose. Because of these observations, it was thought that exercise could constitute an important element in a program to control Type 1 diabetes. However, the several serious studies done in the West have not shown conclusive results. When the quantity of insulin produced is too low, it seems that exercise does not provoke in the muscles, sufficient utilisation of glucose to effectively lower glycemia. It is thought that the weak utilisation of glucose by the muscles could be due to, among other things, the presence of fatty acids in large volume, as a energy sublayer.

If the control of Type 1 diabetes seemed to be little improved by physical exercise, several authors have mentioned that it could still be helpful for diabetics in reducing the risk factors associated with coronary heart disease. Campaigne (3) found a significant reduction in low density lipo-proteins (LDL) among a group of adolescents who had Type 1 diabetes and were enrolled in a physical training program. The effects of body weight, diet and medication was controlled in the study. A retrospective study of 67 adults with Type 1 diabetes by Laporte (4) revealed that those diabetics who practiced team sports in high school and college had a lower incidence of mortality and a lower incidence of cardio-vascular disease than their sedentary colleagues. Also, it was observed that diabetics who participated in sports showed no higher levels of retinopathy as had been feared.

In a critical analysis of studies on the subject, Richter and Galbo (5) concluded that physical training could not be recommended as a means to improve metabolic control in Type 1 diabetes because of the difficulty in controlling glycemia among these patients. However, they specified that our actual knowledge and techniques permit well informed subjects to do physical exercise and to even attain very high levels of athletic performance.

### **Non-Insulin Dependent Diabetes (Type 2)**

As in the case of Type 1 diabetics, Type 2 diabetics often have a lack of capacity to produce sufficient quantities of insulin. However, among many of them, we find a relatively normal level of production of insulin. What characterizes Type 2 diabetics is a certain lack of sensitivity or resistance of the tissues to insulin. This form of diabetes develops gradually and the signs are subtle. Treatment involves the control of diet, regular exercise, medication and in some serious cases, the administration of insulin.

Many studies have shown the immediate effects of exercise on Type 2 diabetes. (5,6,7) Exercise reduces the rate of blood glucose, increases the number of insulin receptors and increases the sensitivity and level of absorption of insulin by the tissues. Because of its hormonal and metabolic effects, it is believed that regular physical exercise can prevent or stop the development of Type 2 diabetes.

In a census of studies, Zinman and Vranic (6) concluded that exercise alone does not have an important effect in improving over the long term, the metabolic anomalies associated with Type 2 diabetes. As Type 2 diabetics are particularly subject to the complications of arterio-sclerosis, the beneficial effects of physical activities on circulating lipo-proteins are indicated in particular. Among obese Type 2 diabetics, exercise may even be an effective therapeutic tool favoring the loss of weight and the absorption of insulin of the tissues.

Richter and Galbo (5) concluded that the practice of regular physical exercise among persons genetically predisposed to Type 2 diabetes could prevent its development, probably by diminishing the demand placed upon the beta cells of the pancreas. The authors added that it is not known actually whether physical exercise can reduce morbidity or mortality rates among diabetics. It is known, however, that physical training can reduce certain risk factors related to the development of arterio-sclerosis, but to a lesser degree than among healthy persons.

### **Recommended physical activities for diabetics**

These recommendations must be addressed to persons whose diabetes is being controlled. One of the most important preoccupations for the diabetic is to maintain a normal level of glycemia. Eating food brings an increase in blood glucose while physical activity, insulin, and oral hypoglycemics exercise an opposite effect. The diabetic who exercises must know how to adjust the different factors in function of their cumulative impact on his or her glycemia. The diabetic must be able to measure his glycemia using an appropriate device.

Among Type 1 diabetics, Nadeau (8) mentions that for a glycemia above 300 milligrams per decilitre ( mg/dl) outside of the period immediately following a meal, the insulin deficit is particularly serious. Therefore, in such cases, physical exercise is not recommended because it could aggravate the metabolic disorder. If the glycemia is normal (70-130 mg/dl), exercise could be done if certain precautions are followed to avoid hypoglycemia. **Before** physical exercise of medium length, that is, less than one hour, the diabetic should consume rapidly assimilable glucides in the form of fruit juice, honey or dextrose tablets. In the case of vigorous physical activity for a longer period, such as cross country skiing, one should take every 30 minutes a drink containing glucides and proteins (yogurt for example). The diabetic should never go more than two hours without eating. In the case of vigorous physical activity for a long period, one should reduce the insulin dosage before the exercise. Such a diminished dose would be 10 to 30 percent of the normal dosage, and would vary greatly from one person to the other. The dosage should be evaluated by the attending physician.

Exercise increases significantly the metabolism of the muscles involved. If insulin is injected into a muscular zone where being greatly exercised, it will be quickly absorbed. To favor a more gradual

absorption, it can be injected at the level of the abdomen. (5,6,8,9)

In healthy persons, vigorous physical activity increases greater sensitivity and absorption which manifests even several hours after the exercise. This phenomena is found also among insulin-dependent persons. Consequently, such a person should never sleep down after a vigorous physical activity without having taken a good meal, because of the risk of delayed hypoglycemia which can manifest several hours later. (8,9) It is especially important for patients who take not only insulin, but beta-blockers, since the symptoms of hypoglycemia, such as abnormal fatigue and incoherent speech and movements, can be hidden by this type of medication. The table indicates the principal recommendations regarding physical exercise for diabetics.

In summary, the regular practice of physical activities and exercise can have beneficial effects for diabetics. In the case of those with Type 2, often obese, exercise favors the loss of weight, increases the absorption of one's own insulin and diminishes the need for oral hypoglycemiants. For persons with Type 1, exercise seems to bring little improvement to the metabolic control of diabetes, but reduces certain risk factors related to the heart. Diabetics must be aware of the possible problems which can arrive during or after exercise and know what to do about them.

## **TABLE 1**

### **Recomendations Regarding Physical Activities**

#### **And Exercise Among Diabetics**

1. The diabetic must be know how to recognize the signs of hypoglycemia and when possible, be accompanied by someone who can go and get glucides when needed. This person must know how to intervene in case of problems.

2. Generally, the diabetic can prevent hypoglycemia by:

- measuring more frequently his or her level of blood glucose during the first phase of exercise;
- diminish his or her dosage of insulin (by one or two units or according to the recommendations of their doctor) or increase the consumption of glucides (by ten to fifteen grams per half hour of exercise) before beginning to exercise;
- inject insulin in a zone of the body which is not affected much by the exercise, for example, the abdomen;
- avoid exercise during the period when insulin levels are highest, that is during the hour following a meal;
- consume drinks rich in glucides, before and during all prolonged physical activities.

3. Because of the risk of micro-angiopathy and neuropathy which can be instigated by a prolonged

period with high blood glucose, it is important to take good care of the feet and wear comfortable shoes.

4. Physical activities like bicycling and swimming are particularly indicated because they involve much less orthopedic risks.

5. The frequency of exercise sessions should be between five and seven times per week. For Type 1 diabetics, daily physical activity will permit one to adopt a regular diet and regular insulin dosage. For Type 2 diabetics, physical activity practiced at least five times per week will permit the maximum expenditure of calories and the control of body weight.

6. The duration of the sessions should be between 20 and 30 minutes for Type 1 diabetics and from 40 to 60 minutes for Type 2 diabetics.

7. The intensity of the activity should be moderate, that is between 50 and 75 percent of the person's functional capacity (see the calculation of the Karvonen equation: the target heart rate should be  $220 - \text{ones age in years} - \text{heart rate while resting} \times 75\% + \text{heart rate while resting}$ ). When it is difficult to measure this, the optimal level is where one feels slightly out of breath, but capable of holding a conversation without much problem.

8. Patients who suffer advanced retinopathy should avoid activities where there are repetitive shocks (such as running and jump rope) or where there are significant increases in arterial tension. Swimming is especially recommended.

9. Some activities such as aerial sports or underwater diving is to be avoided among Type 1 diabetics because of the catastrophic consequences which hypoglycemia can bring.

Sources: American College of Sports Medicine, reference 9, Nadeau, reference 8, and Richter and Galbo, reference 5.

## **Part II: CLINICAL RESEARCH ON THE BENEFITS OF YOGA PRACTICE ON DIABETES**

Many studies have reported the beneficial effect of the practice of yoga on diabetes. (10,11,12,13,14, 15,16, 17, 18, 19). Some studies have mentioned up to 65 percent beneficial effect of yogic therapy for diabetes. (11,13,15, 19) K.N. Udupa has even mentioned 5 cases of juvenile diabetes who were completely controlled by yogic treatment. (17) All of these studies have emphasized the possible mechanism of the yogic practices as:

1. Direct influence on pancreatic secretion by rejuvenation of the pancreatic cells, through alternate abdominal contractions and relaxation, during asanas (yogic postures which produce relaxation) and breathing exercises.

2. Reduction in blood sugar due to muscular exercise involved in the asanas.

S.A.A. Ramaiah's study conducted in Washington, D.C. compared the effects of walking, treadmill, static cycling, Amarantha Kokkuasana (Sitting crane), Nindra Kokkuasana (Standing crane) and Vil asana (Bow pose, rocking, especially side to side). The most effective were found to be the latter. It was concluded that the direct stimulation of the pancreas by the postures rejuvenated its capacity to produce insulin.

Several studies have focused upon why the practice of yoga has been more successful than other forms of exercise. M.V. Bhole (20) and K.N. Udupa (18) have measured the effects of yoga on mental stresses. Muhammad (13) has shown the differences between physical exercises and yoga. He has reported how doing the yogic practices without exertion has more benefits.

The mechanism of yogic practices and other exercises is very different. (21) Yogic practices are supposed to change one's attitude towards the situations of life, by developing mental relaxation and balance. One study focused on the practice of the postures in a slow, smooth and non-exerting manner. (22) The postures were maintained comfortably and easily for a length of time and the patients were taught to focus on breathing or on some infinitely vast object like the sky or the ocean while doing the yoga posture. Two thirds of the patients were significantly benefitted by this treatment. The others also showed improvement.

A number of institutions in India offer treatment programs for diabetes (23,24,25,26) Participants generally stay for between two to five weeks, and follow a program of instruction and practice of yoga asanas for at least an hour in the morning and the evening, dietary control, meditation and breathing exercises. They generally become subjects in on going research projects.

## **TABLE 2**

### **RECOMMENDATIONS REGARDING THE PRACTICE OF YOGA BY DIABETICS**

1. The patient must learn to control and his or her self of diabetes in a wholistic manner, at all levels of your being: physical, emotional, mental, intellectual and spiritual, recognizing the effects of stress, emotional imbalance, and dietary and living habits on the disease condition.
2. Before beginning a program, measure ones exercise toleration. Start with simple movements and positions before progressing gradually to complicated postures.
3. Throughout the program, monitor glucose levels and under the supervision of a physician, and take appropriate medicinal dosages as and when required. After several weeks one may be able to reduce such dosages.
4. Practice in the morning and the evening for 40 to 60 minutes the recommended series of postures according to ones capacity. Practice before meals, but after consuming glucid liquids.
5. Avoid exertion, that is heavy muscular activity. Perform the movements slowly and smoothly, stretching the limbs and joints, and gently compressing the abdomen, without straining. Maintain

the postures for a comfortable length of time. The maintenance period of postures should be increased gradually from 5 seconds to one minute, or even longer depending upon the posture and capacity of the patient.

6. Focus on the breath during the maintenance period of the posture, with the eyes closed or focused on one point, as a means of learning to focus the mind and to manage stress and tension in the body.

7. Perform the Shavasana, or complete peace relax pose on the back, systematically relaxing all of the parts of the body, at the end of the session, or after completing several postures, if one begins to feel fatigued.

8. The following postures have been found to be effective in the control and cure of diabetes (sanskrit names; the english and tamil names are in parentheses):

Dhanurasana (Bow pose, Vilasana), Paschimottanasana (Sitting crane, Amarntha kokkuasana), Padangusthansana (Standing crane, Nindra kokkuasana), Bhujangasana (Serpent pose, Paambuasana), Sarvangasana (Shoulder stand), Ardha-matsyendrasana (Spinal twist), Halasana (Plough pose, Kalapoy asana), Yoga mudrasana (Yogic Symbol pose), Supta Vajrasana (Sitting pose of Firmness), Chakrasana (Wheel pose), Shalabhasana (Grasshopper pose, Vittelasana). (19,22)

9. The practice of Udiyana bandam, or the abdominal squeeze has also been found to be useful. (22)

10. Regulate the diet throughout the program. Avoid simple sugars such as white sugar, honey, glucose and sweets. and eat complex carbohydrates such as wheat, oatmeal, buckwheat, corn, brown rice and beans. Avoid processed food and eat foods with lots of fibre and nutrients.

11. Obese patients can start with different asanas, cleansing processes, bhastrika pranayama and relaxation. Lean and thin patients should start with relaxation and pranayama, and practice in a relaxed manner.(20)

12. Meditation practices have been shown to help the endocrine glands through relaxation of the sympathetic nervous system. (27)

## **CONCLUSION:**

Western medical research has focused upon diabetes as only a physical disorder, requiring only physical modalities of intervention. It has been able to confirm that regular physical exercise does have some beneficial effects in diabetics of both types, and that in those who are genetically predisposed to type 2, it could prevent its development. Western studies have recommended exercise of moderate intensity, as a means to adopt a regular diet and insulin dosage, or to control

body weight and improve circulation. Research in India has recognized it as a psychosomatic disorder with causative factors being sedentary habits, physical, emotional and mental stress. Many studies there have confirmed that the practice of the postures can rejuvenate the insulin producing cells in the pancreas of diabetics of both types, and that doing the postures in a relaxed manner, without exertion, yogic meditation and breathing help most patients to control the causes of diabetes.

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