© Archives of Budo, 2008; 4: 59-64

Received: 2008.08.14
Accepted: 2008.09.01
Published: 2008.09.29

Metabolic effects of a zen meditation and qigong training program in experienced meditation instructors

Authors' Contribution:
- A Study Design
- B Data Collection
- C Statistical Analysis
- D Data Interpretation
- E Manuscript Preparation
- F Literature Search
- G Funds Collection

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Source of support: Postgraduate Studies and Research Department, Higher Medical School, National Polytechnic Institute, Mexico City

Summary

Background: The metabolic effects of meditation have previously been analyzed only with unqualified people who practiced just one form of this discipline. The aim of this work was to analyze the metabolic effects in experienced meditation instructors involved in a program began with zen meditation (without exercise) and later combined this technique with qigong exercise program.

Material/Methods: This two-phased study was carried out on seven qualified meditation instructors and ten people of a control group. The first phase consisted of two parts, in which the instructors underwent a zen meditation program for six weeks (1.5 hours), then a program of combined meditation (zen + qigong exercise) for three weeks. The second phase began after a one-month rest period and consisted of six weeks of combined meditation. During both phases total cholesterol, HDL-cholesterol, triglycerides, total proteins, urea and creatine kinase were determined. The statistical analysis was carried out with variance analysis.

Results: In the first part of the first phase (zen meditation only), the different types of cholesterol increased approximately 20% ($p<0.05$) and the triglycerides 45% ($p=0.047$). However, all parameters decreased ($p<0.01$) during the second part of this phase (combined meditation). In the second phase (combined meditation only), the different types of cholesterol decreased more than 20% ($p<0.05$) from the third week on, the triglycerides decreased 30% ($p<0.05$) from the second week on and urea concentration decreased 15% ($p<0.05$) during first four weeks.

Conclusions: It is probable that the decrease of the different types of cholesterol, triglycerides and urea observed during the combined meditation is due to the set of exercises (mainly isometrics) done during the qigong training program.

Key words: cholesterol • qigong • physical activity • triglycerides • zen meditation

Full-text PDF: http://www.archbudo.com/fulltxt.php?ICID=869644

Word count: 2863
Tables: –
Figures: 9
References: 23

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Background

Meditation in oriental martial arts and combat sports is a part of the training and is used with the aim of silencing the mind and develop the capacities of relaxation, concentration and reducing stress in difficult situations [1]. In recent years oriental meditation has become widely practiced by people with sedentary life styles to combat the stress of daily life, frequently without taking into account that in the oriental culture meditation is combined with exercise and an adequate diet.

Physiologically, oriental meditation can be divided into two types; that practiced with and without physical exercise. The best known techniques in the first group are qigong and yoga, which contain a set of physical movements together with verbal techniques [2,3]. Among the best known techniques in the second group are zen and transcendental meditation, which are based on verbal techniques, relaxation and controlled breathing [4–6].

The effects of qigong meditation on brain function [7,8] as well as on the cardiovascular [9], neuroendocrine and immunological [10–12] systems have already been researched. There have been several reports of the physical and psychological benefits as well as the medical application of this type of meditation [13–15]; other studies indicate that it results in mental disorders [16–19]. The physiological effects depend on the type of meditation, the individual characteristics of the meditator, and the duration of each session as well as that of the total program [10].

Data about the effect meditation on the profile of blood lipids have been reported principally in relation to people with elevated cholesterol or blood pressure [20]. In a recent study no significant change was found in such a profile after 16 weeks of transcendental meditation on people at risk for coronary heart disease [13]. In several studies a yoga program resulted in a positive effect on the levels of blood lipids [21,22]. With a qigong meditation program, there was a tendency towards a reduction of blood triglycerides and the different kinds of cholesterol [9]; nevertheless, such tendency was always on the limit of significance.

On one hand, the majority of studies reported in the medical literature have been done on unqualified people. On the other hand, the metabolic effects have been studied only in relation to active or passive meditation and not with a combination of the two. The metabolic response would probably be stronger if after a period of passive meditation, another form of this discipline were practiced with exercise included. In any case, the mechanisms of the metabolic effects of meditation are currently not clear.

The objective of this work was to research the effects of zen meditation and combined meditation (zen + qigong exercise) on the metabolic blood parameters (profile of lipids, concentration of urea and creatine kinase) of a group of experienced instructors who practiced these techniques to their maximum duration.

Material and Methods

Participants

We studied a group of instructors of passive meditation (transcendental) with 3–12 years of experience, who learned the combined techniques of zen meditation before the study. Only seven of 12 participants completed the study, including two men and five women (average age, 34.1±2.8 years; average body weight, 74.3±5.2 kg). All the participants were clinically healthy, but sedentary. Instructor number one, with twelve years experience in oriental meditation and two years of studies in China, directed the group. He and participants number two and four had the greatest amount of experience in meditation (12, 6, and 5 years). The control group included 10 healthy sedentary people, three men and seven women (average age 36.2±4.3 years; average body weight, 75.8±4.9 kg). Written informed consents were obtained from the subjects.

Interventions

A longitudinal, prospective and sequential study with two groups (experimental and control) was carried out. The study was done in two phases, the first of which lasted nine weeks and the second six weeks. During the first six weeks of phase one only zen meditation was practiced. For the last three weeks of the first phase, combined meditation was conducted. There was a one-month period between the two phases in which the instructors continued their habitual work with their students (that is, meditation without exercise and without our intervention). During the second phase combined meditation was practiced for the whole time. People of the control group had no participation in any phase of the meditation program.

In the zen program, the meditation was based on verbal techniques, relaxation and controlled breathing, and was practiced in a fixed position [4,5]. Daily sessions lasted 1.5 hours and were carried out five days per week in the morning (while still fasting) in a dark room. In the qigong program the meditation consisted of a series of eight movements associated with controlled breathing and mental relaxation [3]. In the first week the repetition of this series of eight movements was gradually increased until reaching the practice of 7–8 sets of such movements, or 56–64 total exercises. The combined meditation consisted of zen meditation for 45 minutes, followed by qigong meditation the next 45 minutes.

Blood sampling

Every week capillary blood samples were taken from a finger after meditation and while the participants were still fasting. In this way, the process of meditation was not affected. With the same frequency and under the same conditions capillary blood samples were taken from the control group. The following blood parameters were determined in serum: urea, creatine kinase (CK), triglycerides, total proteins, total cholesterol, and cholesterol of high density lipoproteins (HDL-C). A semi-automatic photometer (Microlab 200) and enzymatic reactive from Spinreact were used. The HDL-C was determined in the supernatant after precipitating the serum with a solution of phosfotungstic acid and

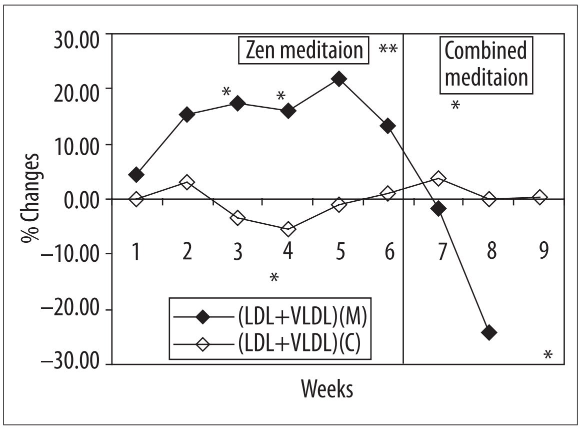

Figure 1. The percentage of change of the average levels of HDL-C during the 9 weeks of the first phase of this study. M – experimental group, C – control group, *p<0.05, **p<0.01.

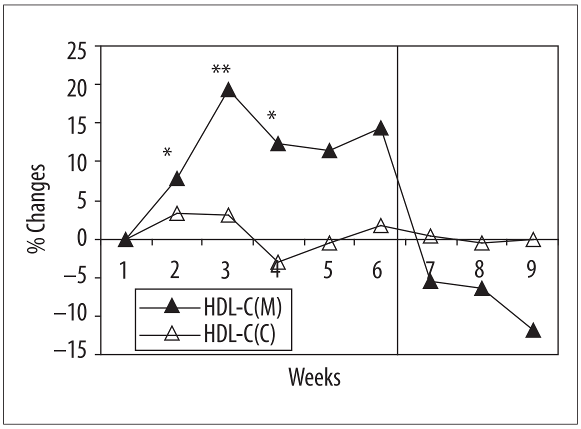

Figure 2. The percentage of change of the average levels of (LDL+VLDL)-C during the 9 weeks of the first phase of this study. M – experimental group, C – control group, *p<0.05.

magnesium chloride. The sum of LDL and VLDL cholesterol (LDL + VLDL)-C was determined by calculating the difference between total cholesterol and HDL-C. A standard solution or control serum was used for all determinations. The reliability for determination of the blood parameters was between one and two percent, depending on the specific parameter. Variance analysis (ANOVA) was used for the statistical analysis.

Results

The concentration of total proteins in the experimental as well as control group varied less than 4% in relation to the initial level, which means that possible changes in plasma volume are also less than 4% and thus do not significantly affect the results of the measured metabolic blood variables.

First phase

At the beginning of the first phase of the study, which consisted of nine weeks altogether, the blood variables of the participants had the following average values: 1.17±0.23 mmol/l of HDL-C, 3.47±0.92 mmol/l of (LDL+VLDL)-C. An increase of approximately 20% (p<0.05) in the average values of the different types of cholesterol (1.37±0.33, 4.22±1.11 mmol/l, respectively) was observed after the six weeks of zen meditation (Figure 1,2). In the two most experienced instructors, the increase of the (LDL + VLDL)-C was over 30%. In the control group no significant changes were observed in the levels of all types of cholesterol, with exception of a moderate decrease in the (LDL+VLDL)-C during the fourth week. The triglycerides increased 45% (p=0.054) (Figure 3) during the first 6 weeks (from 1.72±1.42 mmol/l to 2.50±1.85 mmol/l) for the experimental group, without any significant change in the control group. It is interesting that the three most experienced instructors (number one, two and four) had the highest levels of triglycerides at the beginning of the study and during the phase of zen meditation.

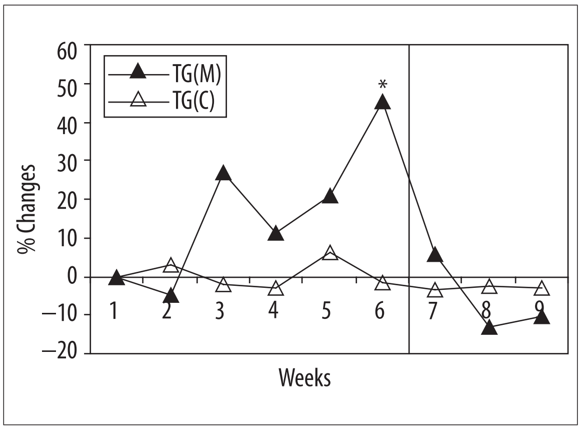

Figure 3. The percentage of change of the average levels of triglycerides during the 9 weeks of the first phase of this study. M – experimental group, C – control group, *p<0.05.

During the last three weeks of the first phase (Figures 1–3), when the qigong training program was included, a decrease in all the blood variables studied was observed. At the end of the first phase of the study, (LDL+VLDL), HDL-C and triglycerides levels decreased 24%, 12% y 11%, (p=0.011, 0.107 and 0.7 respectively), in relation to the initial levels of the study. Comparing the values of these blood variables at the end of the first phase with those at the end of the sixth week of this phase, the decrease was 34%, 23% and 38%, respectively (p=0.002, 0.043 y 0.011 respectively). In the three most experienced instructors (number one, two and four) the decrease of the (LDL + VLDL)-C at the end of the first phase was 82%, 60% y 28% compared with the end of the sixth week.

The LDL+VLDL/HDL ratio varied within 6% during the first six weeks of the first phase and also had a tendency to increase 19% (p>0.05) in the seventh week and to decrease (14%, p>0.05) during the eighth and ninth week of this phase. In the three most experienced instructors, changes were more significant (data not presented).

CK activity and urea concentration are the principal biochemical indicators of physical load. The fact that the three most experienced instructors had high initial levels of CK caused the initial levels of this variable to be higher in the experimental (75.7±61.5) than the control group (43.0±13.5),

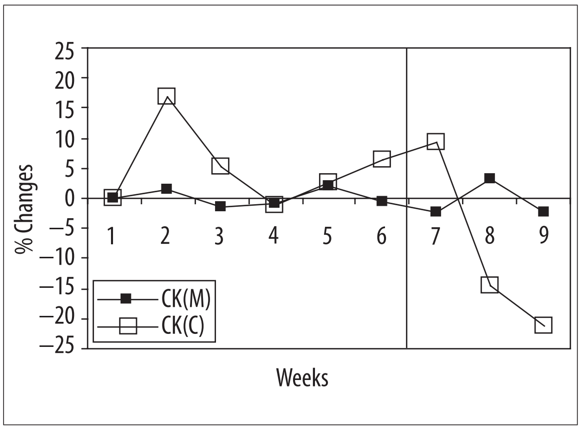

Figure 4. The percentage of change of the average levels of CK activity during the 9 weeks of the first phase of this study. M – experimental group, C – control group.

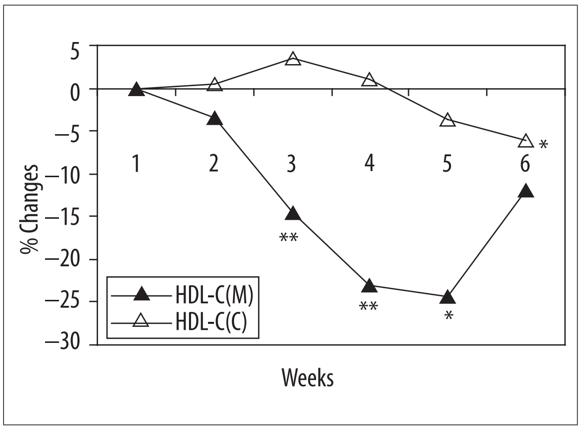

Figure 5. The percentage of change of the average levels of HDL-C during the 6 weeks of second phase of this study. M – experimental group, C – control group, *p<0.05, **p<0.01.

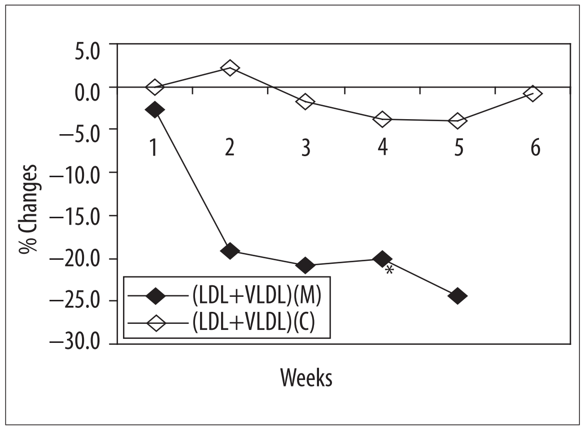

Figure 6. The percentage of change of the average levels of (LDL+VLDL)-C during the 6 weeks of the second phase of this study. M – experimental group, C – control group, *p<0.05.

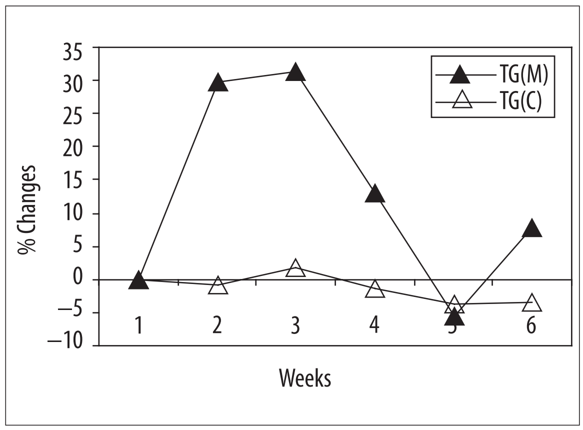

Figure 7. The percentage of change of the average levels of triglycerides during the 6 weeks of second phase of this study. M – experimental group, C – control group.

although the difference was not statistically significant. The differences in the initial levels of urea for the two groups (28.7±9.6 and 24.7±5.9, respectively) were not statistically significant either. Neither CK activity changes (Figure 4) nor urea concentration changes were significant in the experimental and control groups when compared with initial levels. At the end of the first phase (after three weeks of combined meditation), there was a decrease of 21% in CK activity in relation to the initial levels (p>0.05) and 26% in relation to the levels at the end of the sixth week (p<0.05). Urea concentration in the experimental group showed a tendency towards a reduction (p>0.05) during the six weeks of the first phase (data not presented).

Second phase

During the month of rest between the two phases the instructors, as usual practiced passive zen or transcendental meditation with their students without a our intervention. Before the beginning of the second phase of the study (combined meditation), the average initial levels of HDL-C and (LDL + VLDL)-C were elevated in the same three instructors (1.28 and 4.04 mmol/l, respectively). There was a significant decrease (p=0.047) in the average concentration of (LDL+VLDL)-C and HDL-C (p<0.01) during the first four weeks (Figure 5,6), without any significant changes in the control group. The average LDL + VLDL / HDL ratio decreased 16% (p>0.05), a change that occurred entirely in the last week.

The average triglyceride level (Figure 7) increased 30% (p>0.05) in the first week and later decreased to the initial level. The change in the average CK activity was similar to the behavior of triglycerides: in relation to the initial level, it increased 60% in the first week of the second phase of the study (p=0.047), decreased in the fourth week, and increased 85% (p=0.009) in the last week (Figure 8). The concentration of urea decreased until reaching its minimum level in the fourth week (p=0.048), and then began to increase (Figure 9).

There was a significant difference in relation to the decrease in HDL-C (p=0.011) as well as to the decrease in triglycerides (p=0.023) in the second part (three weeks of combined meditation) compared to the first part (six weeks of passive meditation) of the first phase of this study. The difference

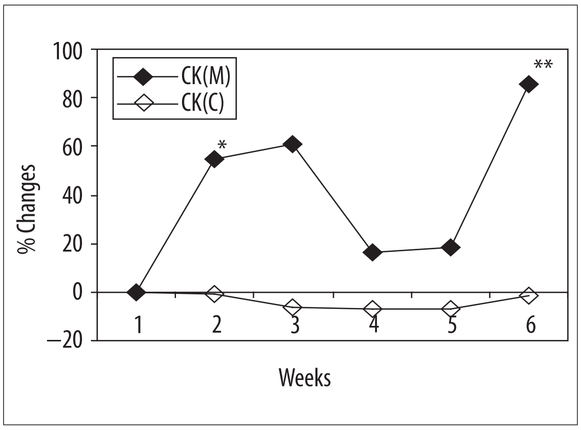

Figure 8. The percentage of change of average levels of CK activity during the 6 weeks of the second phase of this study. M – experimental group, C – control group, *p<0.05, **p<0.01.

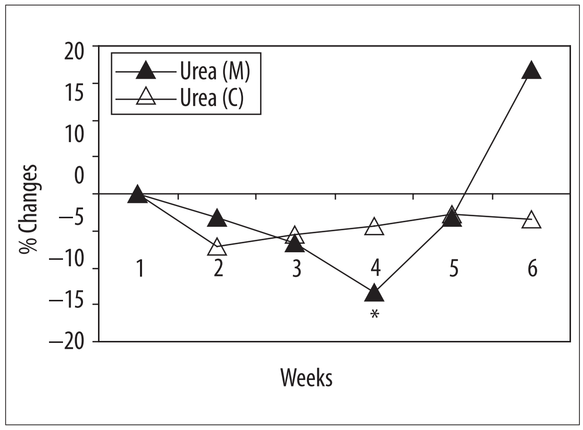

Figure 9. The percentage of change of the average levels of urea during the 6 weeks of the second phase of this study. M – experimental group, C – control group, *p<0.05.

was border line in relation to the decrease in total cholesterol and the (LDL + VLDL/HDL) ratio in the second part compared to the first part of the first phase. Accordingly, there was a significant difference in relation to the decrease in HDL cholesterol (p=0.005) as well as to the decrease in triglycerides (p=0.008) in the second phase of the study (six weeks of combined meditation) compared with the first part of the first phase (six weeks of passive meditation). Once again, the difference was border line in relation to the decrease in total cholesterol in the second phase compared to the first part of the first phase. According to the T of Turkey, there was not any significant difference between the two periods of combined meditation (the three weeks of the second part of the first phase and the six weeks of the second phase) in relation to the corresponding decreases in any of the parameters studied.

Discussion

Although the mechanisms of the metabolic effects of meditation are not clear, several studies have reported that meditation affects liver and kidney function. For example, in one study transcendental meditation decreased the blood flow in the liver [2]. This same phenomenon could explain the reduction in GOT, GPT and urea found in a recent study with a qigong meditation program [9]. Some authors, such as those involved in a study of hatha yoga, link this decrease in urea to controlled breathing during meditation. It is thought that controlled breathing eliminates CO_2 ,which leads to the carboxylation and oxidation of proteins [23].

In the current study, after adding qigong meditation to the program we observed a surprising change. Instead of the negative effect that meditation without exercise showed on the lipid profile, there was now quite a strong positive effect in a very short time. The increase in TG was only significant in the seventh week and might have been influenced by diet. As different types of cholesterol changed in the same way and there was not any change in plasma volume, it is probable that the principal mechanism of this effect is related to the liver, as was reported in one study. The reduction of the blood flow in the liver found in that study could be the key factor for the parallel increase in the different cholesterols, given that this organ has an important role in the metabolism and the transport cycle of cholesterol. In agreement with this hypothesis are the following data: the tendency towards a decrease in the concentration of urea in the first phase of the study, its significant reduction in the second phase, and the decrease of urea and the activities of GPT and GOT during qigong meditation that was reported in a recent study [9].

It is probable that the reduction in different kinds of cholesterol blood levels after including a qigong training program in the current study is related mainly to the physical exercises. The drastic change produced by the qigong training program after passive meditation might be related to an augmented blood flow in the liver and other organs.

The aforementioned recent study [9] found only a tendency toward a decrease of HDL-cholesterol and LDL-cholesterol in the blood due to meditation. However, only novices in the practice of meditation participated in that study, and all of them had a high level of physical activity. On the other hand, in our study there were 3 important differences: 1) only experienced instructors of meditation participated, all with a sedentary life style, 2) the effect of a qigong training program was observed after six weeks of passive meditation, and 3) the duration of a meditation session was maximum duration (1.5 hours as compared to 0, 5 hours in the study aforementioned). Although it appears that the inclusion of the qigong training program was the key factor, it can not be discarded that our results were affected by the condition of natural hypoxia (2 200 m above sea level), in spite of the fact that we worked with people native to this altitude. The drastic changes caused by the qigong training program could be explained by the sedentary life style of the participants, since isometric exercise in the qigong training program is not common in the daily life of people who practice passive meditation and could have been a strong stimulus for the metabolism of the lipids in the participants of this study.

In the second phase of the study (combined meditation), the decrease of different kinds of cholesterol confirmed the results found in the second part of the first phase. The significant increase in triglycerides and CK activity in the first three weeks of second phase could be related to the acute adaptation to the exercises of the qigong program after the one-month period of not practicing this type of meditation. The significant decrease in urea in the first four weeks of the second phase coincides with the results of the aforementioned study [9]. The increase during the last week in CK activity and urea concentration probably indicate that had already adapted themselves to the exercise routine of qigong. The data of this study show that such effects are greater in people with more experience in meditation.

Conclusions

The data of this study show that in experienced meditators with a sedentary life style, zen passive meditation causes a significant increase in cholesterol related blood variables. On the other hand, qigong exercise program combined with zen meditation reverts such an effect. It is possible that the explanation lies in the difference between the passive nature of zen meditation and the active nature of qigong, possibly related to an augmented blood flow in the liver and other organs. The sets of movements practiced in the qigong training program oblige the participants to exert themselves. It will be necessary to evaluate the metabolic effects of combined meditation in unqualified practitioners of these disciplines under the same conditions.

Acknowledgemements

We are indebted to the following institutional funding sources for their invaluable help in this work: COFAA and CGPI, both of them at The National Polytechnic Institute in Mexico City.

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