Health and Disability

Assessment of hormonal parameters and psychological well-being in healthy subjects after a Taoist qigong program: An exploratory study

FRANCISCA M. VERA,[1] JUAN M. MANZANEQUE,[1] FRANCISCO M. RODRÍGUEZ,[2] MIGUEL VADILLO,[1] FEDERICO NAVAJAS,[2] ANA I. HEINIGER,[3] VIDAL PÉREZ[4] and M. JOSÉ BLANCA[1]

[1]*Universidad de Málaga, Málaga, Spain*
[2]*Unidad de Gestión Clínica de Laboratorio AGS, Málaga, Spain*
[3]*Servicio de Hematología, Hospital Regional Universitario de Málaga, Málaga, Spain*
[4]*Servicio de Análisis Clínicos, Hospital Regional Universitario de Málaga, Málaga, Spain*

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Qigong is an ancient form of health maintenance, which is part of Traditional China Medicine. Numerous beneficial mental and physical effects have been classically ascribed to this traditional psychosomatic method. The purpose of this work has been to assess the effects of Taoist qigong practice on several hormonal parameters of the Hipotalamic-Pituitary-Adrenal axis and specific measures of psychological well-being in healthy subjects. Forty-three healthy volunteers participated in the study, of whom 22 were randomly allocated to the experimental group, and 21 were assigned to the control group. Experimental participants underwent a qigong training program for one month. Blood samples for the quantification of hormonal parameters, and several instruments to assess anxiety and depression symptoms as well as subjective sleep quality, were obtained before and after the program. Statistically significant differences were found between the experimental and control groups, with the experimental group showing lower blood levels of adrenocorticotropic hormone (ACTH). This study shows that Taoist qigong is a psychosomatic method able to exert a modulatory action on ACTH levels in healthy subjects. We consider the need to continue exploring the psychobiological modulation of this qigong method and its possible repercussion for human health care.

Key words: Qigong, endocrine modulation, psychological well-being, psychosomatic, health.

Francisca M. Vera, Departamento de Psicobiología y Metodología de las Ciencias del Comportamiento, Facultad de Psicología, Universidad de Málaga, Campus de Teatinos, 29071 Málaga, Spain. Tel: +34 952132510; fax +34 952132621; e-mail: pvera@uma.es

INTRODUCTION

Qigong is an ancient Chinese psychosomatic discipline which is part of Traditional Chinese Medicine. It can be traced back thousands of years, being a highly popular practice nowadays, particularly in China, for the purpose of health maintenance and healing (Wang, Chan, Ho, Tsang, Chan & Ng, 2013). Qigong, of which there are hundreds of variations, integrates physical movements, breathing and meditation in a single multifaceted practice. Practicing qigong simultaneously trains the body, mind and qi (vital energy) for the benefits of physical, psychological and spiritual health (Zeng, Luo, Xie, Huang & Cheng, 2014). According to Traditional Chinese Medicine, qi is an energy that sustains human well-being and assists in healing (Tiwari, Chan, Ho *et al*., 2014). One of the main traditions within qigong is the Taoist school. This particular school emphasizes naturalness, using specific body movements and a relaxed state of the mind to improve health and increase longevity (Vera, Manzaneque, Rodríguez, Bendayan, Fernández & Alonso, 2016).

Qigong is widely practiced not only for the physical improvement it provides, but also to manage stress and enhance psychological well-being (Wang, Chan, Ho, Chan, Ng & Chan 2014). Thus, in recent years, an increasing number of studies have documented the effectiveness of qigong to improve psychological well-being, including anxiety and depression symptoms (Abbott & Lavretsky, 2013; Chan *et al*., 2013, 2014; Hsieh, Chang, Tsai & Wu, 2015; Hwang, Chung, Cho, Song, Kim & Kim, 2013; Manzaneque, Vera, Rodriguez, Garcia, Leyva & Blanca, 2009; Ng & Tsang, 2009; Tsang & Fung, 2008; Tsang, Tsang, Jones *et al*., 2013; Wang *et al*., 2013, 2014) and sleep subjective quality (Chan *et al*., 2014; Manzaneque *et al*., 2009; Wassom, Lyons, Pahwa & Liu, 2015).

Psychological well-being, in general, has been linked to the Hipotalamic-Pituitary-Adrenal (HPA) axis function (Simpsom, McConville, Rae *et al*., 2008; Vera, Manzaneque, Maldonado *et al*., 2009; Wright, Valdimarsdottir, Erblich & Bovbjerg, 2007). In fact, an association between HPA axis dysregulation and mental illness has been reported (Leggett, Zarit, Kim, Almeida & Klein, 2015; Naughton, Dinan & Scott, 2014). Thus, dysregulation of the levels of HPA axis hormones, such as adrenocorticotropic hormone (ACTH) and cortisol, has been said to be related to pathologies associated with stress, including poor sleep quality, negative mood, anxiety and depression (Capaldi, Handwerger, Richardson & Stroud, 2005; Greaves-Lord, Ferdinand, Oldehinkel, Sondeijker, Ormel & Verhulst, 2007; Het, Schoofs, Rohleder & Wolf, 2012; Hsiao, Lai, Chen *et al*., 2014; Jacobs, Myin-Germeys, Derom, Delespaul, van Os & Nicolson, 2007; Leggett *et al*., 2015; Mannie, Harmer & Cowen, 2007; Oswald, Zandi, Nestadt, Potash, Kalaydjian & Wand, 2006; Tsang & Fung, 2008). On the contrary, dehydroepiandrosterone (DHEA), (and its sulfate form DHEA-S), another hormone released from the adrenal

gland under the influence of ACTH, like cortisol, has been associated with an improvement in psychological well-being and mood (Binder, Weber, Ehrismann *et al*., 2009; Brooke, Kalingag, Miraki-Moud *et al*., 2006; Ceballos, France & al'Absi, 2007; Gurnell, Hunt, Curran *et al*., 2008; Hunt, Gurnell, Huppert *et al*., 2000; Kasala, Bodduluru, Maneti & Thipparaboina, 2014; Morales, Nolan, Nelson & Yen, 1994), among other effects. As a matter of fact, the beneficial role of DHEA on the feeling of well-being has been suggested to be related, at least in part, with DHEA opposing action of cortisol through its competition in their synthesis and release by the adrenal gland (Boudarene, Legros & Timsit-Berthier, 2002). Regarding the positive effects of DHEA on psychological well-being, recent meta-analyses have revealed, however, conflicting results (Rutkowski, Sowa, Rutkowska-Talipska, Kuryliszyn-Moskal & Rutkowski, 2014).

It is interesting to note that blood levels of stress-related hormones ACTH and cortisol may be lowered by qigong practice (Chan *et al*., 2013; Jones, 2001; Jung, Shin, Kim, Shin & Lee, 2006; Lee, Lee, Kim & Moon, 2003; Lee, Kang, Lim & Lee, 2004; Ryu, Lee, Shin *et al*., 1996; Sousa, Goncalves, Machado *et al*., 2012); however, other studies have not reported any changes in the activity of the HPA axis after qigong training (Chen, Meng, Milbury *et al*., 2013; Hsieh *et al*., 2015; Hwang *et al*., 2013; Park, Hong, Lee *et al*., 2014; Zeng *et al*., 2014). Therefore, although some researchers have indicated that qigong practice can modulate the function of the HPA axis by influencing cortisol, this action needs further confirmation given the relatively contradictory nature of some results. With respect to the DHEA blood levels, this psychosomatic training has been scarcely investigated with regard to its effects on this adrenal hormone; in this sense, we have found only one study showing no significant changes (Ryu *et al*., 1996). In the same manner, although qigong practice has been demonstrated to exert a significant hormonal modulation, there is a marked lack of scientific research in the Western world about the effects of Taoist qigong. In addition, the possible influence of this specific ancient method on psychological well-being, to the best our knowledge, has never been investigated before.

Therefore, the present study provides a first attempt to explore the effect of Taoist qigong on HPA axis function and psychological well-being. Specifically, the purpose of this work has been to assess the effects of this psychosomatic method on several hormonal parameters of the HPA axis (ACTH, cortisol, and DHEA-S), anxiety and depression symptoms, as well as subjective sleep quality in healthy subjects.

METHOD

Participants

The participants were all Psychology students from the University of Malaga who volunteered to take part in the study, following an oral announcement in class by the teacher. A preliminary interview was conducted to obtain general information about the would-be participants. The main inclusion criterion for both the experimental and control groups was to be in good health and to have regular lifestyle habits. Subjects were screened to exclude those with any type of physical or mental chronic disease and/or those who had received pharmacological treatment in the three months prior to the experiment. Only healthy subjects not taking any type of drugs and with regular life habits were chosen to be part of the experimental or control groups. All were asked to follow their normal life-styles while the experiment was being conducted. Female participants were all within the first 10 days of their last menstrual period.

All subjects selected to be part of the control or experimental group were contacted in the following days after their initial interview. Participants were selected from among a larger group of 100 volunteers, and the recruitment took place within the first two months of class. Forty-three subjects, aged 18–22 years, of whom 10 were males and 33 females, participated in this study.

The study was conducted according to the Declaration of Helsinki (Harriss & Atkinson, 2015), and the Ethics Committee of the University of Malaga approved this study (number of register CEUMA: 18-2017-H). Informed consent was obtained from all participants after the nature of the procedure had been fully explained to them; they were also assured that their information would remain strictly confidential and that they had the right to withdraw from the study at anytime. In addition, participation of the included subjects was done after signing the dated, written informed consent form.

Study design

This exploratory study followed a randomized controlled trial. The participants were randomly allocated to either the experimental group or to the control group. Pretest was performed on all the participants the day before training began in the experimental group. Posttest was performed twenty-four hours after the last training session of this group. The experimental group practiced Taoist qigong over a period of one month, while the control group just kept their regular daily habits.

Blood samples for the quantification of endocrine parameters (ACTH, cortisol, and DHEA-S) were taken on all participants at pretest and posttest. Likewise, anxiety and depression symptoms, as well as subjective sleep quality, were assessed in the same manner.

Intervention

The form of qigong taught to experimental subjects belongs to the Taoist school of qigong, one of the five main traditions in which qigong can be divided (the other being the Buddhist, Confucianist, Martial, and Medical schools). While all qigong schools use specific body movements to achieve mind body integration and preserve health, the Taoist school of qigong has a particular approach emphasizing naturalness for the attainment of these goals. Thus, its movements follow a very natural path in terms of physical performance, while the breathing is conducted naturally without any conscious manipulation.

The specific form of Taoist qigong that the experimental group practiced is a simple classical method that contains seven distinct movements which are practiced with full concentration and a relaxed state of the mind. The whole physical sequence contains seven discrete movements which are repeated six times. The

movements mainly involve stretching movements of the waist, arms, and trunk, without changing the position of the feet. It is, therefore, a very simple set of exercises, since no movement of the legs is required, except for flexing in the last exercise.

Throughout the practice, a natural and relaxed breathing is required. Thus, the practice entails the integration between movements and natural breath whilst a focused state of relaxed awareness is maintained.

Experimental subjects underwent a qigong training program consisting of three days of group practice per week plus some individual sessions, for the period of one month. These subjects gathered in the afternoon, on Monday, Wednesday and Friday, in a room adjoining our laboratory where the practice sessions were conducted. The psychosomatic exercise took place and was taught under the guidance of a qualified qigong instructor of this discipline. Each session lasted for 25–30 minutes and the subjects were encouraged, but not required, to keep practicing on their own on the weekends. The training included the group sessions conducted by the instructor and some additional sessions carried out individually at home on the other days, including the weekends. The amount of individual training varied from one subject to another, but typically consisted of one extra session during the week, plus one more on the weekend. This individual training usually had half the duration of the regular ones. In total, 15–20 training sessions were carried out by the experimental subjects, of which 5–8 were performed individually with a short duration of about 12–15 minutes.

The control group did not undergo any kind of intervention. Control subjects were just asked to keep their daily habits and routines without any change.

Blood sampling

The day before training began in the experimental group and twenty-four hours after the last session of practice concluded, one month later, blood samples were drawn from all subjects for the quantification of ACTH, cortisol and DHEA-S. Blood was drawn by venepuncture at 9:00 am. ACTH was collected into tubes containing EDTA, centrifuged immediately in a refrigerated centrifuge, and stored at –20 °C. Plasma ACTH concentrations were analyzed with a two-site chemoluminescence immunometric assay. Cortisol and DHEA-S were assessed with a competitive chemoluminiscence enzyme immuneassay. All samples were quantified by using Modular Analytics E170 (Roche Diagnostics).

Assessment of anxiety and depression symptoms, and subjective sleep quality

After blood samples were taken from all subjects, several self-report measures assessed anxiety and depression symptoms and subjective sleep quality before and after following the qigong program.

- Anxiety symptoms were measured with the trait form of the Spielberger State-Trait Anxiety Inventory (STAI). The trait form of STAI is a 20-item instrument, measuring enduring levels of anxiety. A higher score indicates a higher anxiety level.
- Depression symptoms were assessed with the Beck Depression Inventory (BDI). The BDI is a self-rated scale to evaluate the severity of depression; it consists of 21 items (range from 0 to 3 points each). A higher score indicates a more severe depression.
- The subjective sleep quality along the last month was measured with the Pittsburgh Sleep Quality Index (PSQI). This questionnaire generates seven component scores (range from 0 to 3): Subjective Sleep Quality, Sleep Latency, Sleep Duration, Habitual Sleep Efficiency, Sleep Disturbances, Use of Sleeping, Medications and Daytime Dysfunction. The sum of these subscale scores yields a global score of subjective sleep quality (range from 0 to 21); a higher score is indicative of a poorer subjective sleep quality.

Statistical analyses

A between-group analysis of covariance (ANCOVA) was performed on several dependent variables: endocrine parameters (cortisol, ACTH, and DHEA-S), anxiety and depression symptoms (STAI and BDI scores), and subjective sleep quality (PSQI scores). The qigong training was considered as an independent variable with two levels (absence or control group, and presence or experimental group) and the respective pretest scores of each dependent variable as covariates. Thus, the differences between groups in posttest (twenty-four hours after the last session) were estimated with the differences in pretest scores removed. A value of $p < 0.05$ was considered to be significant. The software package IBM SPSS Statistics Version 19 was used for all analyses.

RESULTS

This research was performed with forty-three participants (see Fig. 1). Twenty-two subjects (17 females and 5 males) were randomly allocated to the experimental group, and 21 (16 females and 5 males) to the control group. Although forty-three volunteer healthy participants were enrolled in this study, after random assignment, one experimental subject (female) decided to leave the experiment within the first few days of onset for personal reasons totally unrelated to the study. Likewise, two control participants (one male and one female) did not attend the extraction of blood samples at posttest; in addition, the blood samples of two other control participants (two females) were lost. Finally, twenty-one subjects (16 females and 5 males) in the experimental group, and 17 (13 females and 4 males) in the control group completed the study. The percentage of male subjects in the control and experimental groups was 23.5% and 23.8%, while the percentage of female subjects was 76.5% and 76.2%, respectively.

Participants were divided into those with and without missing data, and an independent *t*-test was performed to establish mean differences in the pretest on the variables involved in the study. Results showed no differences between the two groups on any variables, indicating a similar pattern across both. Consequently, participants with missing data were excluded after the random assignment in the analysis. Finally, participants with data available on pretest and posttest were analyzed according to

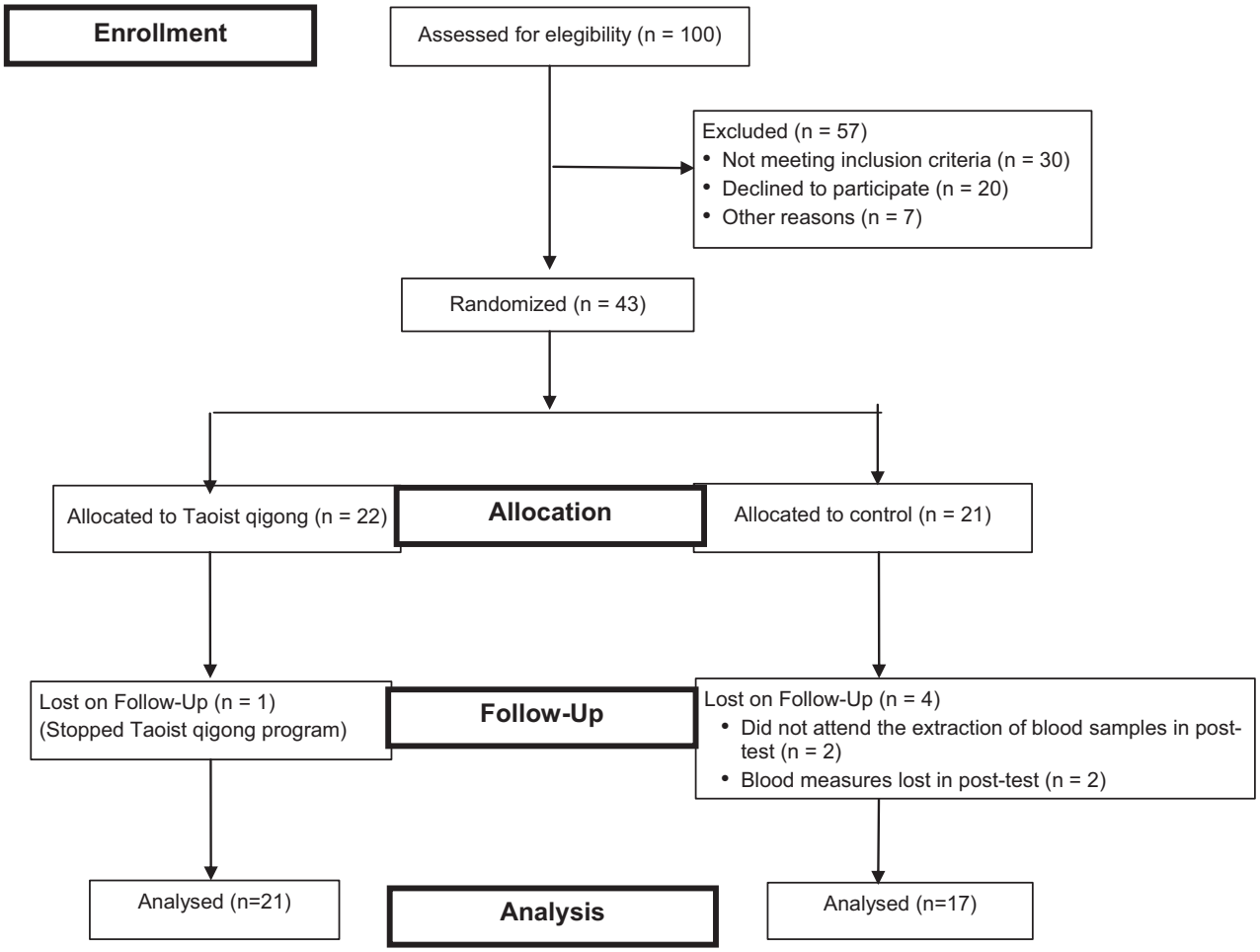

Fig. 1. Recruitment diagram

their original allocation, in accordance with a per protocol analysis.

Table 1 summarizes information on age, weight and height as well as on outcome variables at baseline of all participants. As it is shown, none of these variables were significantly different between the control and experimental groups.

Effects of experimental treatment in posttest, after adjustment for covariates in pretest, were only found in the ACTH levels. The results are presented in Table 2. Specifically, it was found that the experimental group had lower values in posttest ACTH levels (p = .02), as compared to control.

The experimental and control groups showed no statistical differences at posttest in relation to anxiety and depression symptoms, and subjective sleep quality measures.

Table 1. *Means (standard deviations in brackets) of age, weight, height and outcome variables in baseline in control and qigong groups, t-test for independent sample and p-value*

	Control	Qigong	*t*	*p*
Age (year)	19.82 (1.29)	19.86 (1.20)	–0.83	0.93
Weight (kg)	65.73 (6.43)	62.00 (8.88)	1.45	0.16
Height (m)	1.68 (0.70)	1.65 (0.85)	1.33	0.19
Hormone				
Cortisol (μg/L)	163.21 (60.73)	157.93 (59.12)	0.27	0.79
ACTH (pg/mL)	17.47 (15.27)	19.52 (14.73)	–0.42	0.67
DHEA-S (μg/mL)	2.91 (1.22)	3.36 (1.55)	–0.98	0.33
Anxiety and depression symptoms				
STAI –TRAIT score	21.53 (10.20)	18.67 (11.49)	0.80	0.43
BDI score	8.94 (6.01)	8.48 (6.26)	0.23	0.82
Subjective sleep quality				
PSQI score	4.65 (2.15)	5.14 (2.20)	–0.70	0.49

DISCUSSION

The main finding of the present investigation is that Taoist qigong practice induces a significant modulation on the blood levels of ACTH in healthy subjects with no previous qigong experience. These results are, to the best of our knowledge, the first ones to be published to date, showing that this specific qigong method exerts a modulatory hormonal action on a particular component of the HPA axis.

The reduction in ACTH levels appears to suggest a decrease in the functional activity of the HPA axis; however, no changes were observed in the regulation of adrenal hormones cortisol and DHEA-S. It could certainly be debatable why statistical significance was reached in one measure only, as far as endocrine measures are concerned. However, it must be noted that this finding alone reflects a peculiar action of qigong on endocrine function, which lends itself to numerous interesting explanations and implications. As a matter of fact, similar results have been

Table 2. *Adjusted means in posttest (confidence intervals in brackets) for the concentrations of endocrine variables, STAI, BDI and PSQI scores, in control and qigong groups, F statatistics, p-value and partial eta squared after performing ANCOVA with respective pretest as covariante*

	Control	Qigong	*F*	*p*	η^2
Hormone					
Cortisol (μg/L)	174.68 [153.02, 196.35]	168.08 [148.59, 187.57]	0.21	0.65	0.006
ACTH (pg/mL)	24.06 [19.70, 28.42]	16.95 [13.04, 20.87]	6.03	0.02	0.147
DHEA-S (μg/mL)	3.53 [2.89, 4.071]	3.72 [3.23, 4.21]	0.28	0.60	0.008
Anxiety and depression symptoms					
STAI –TRAIT score	19.72 [17.45, 21.99]	17.89 [15.85, 19.93]	1.47	0.23	0.040
BDI score	7.59 [5.86, 9.32]	5.81 [4.25, 7.36]	2.43	0.12	0.065
Subjective sleep quality					
PSQI score	3.63 [2.90, 4.37]	3.48 [2.83, 4.15]	0.09	0.77	0.003

obtained by Ryu *et al*. (1996), who also found that blood ACTH levels declined while cortisol and DHEA-S levels were not significantly changed. Lee *et al*. (2004), however, reported decreases of cortisol and ACTH levels one hour after a qigong training program.

Although some studies have revealed changes in cortisol levels after qigong practice, related literature has presented conflicting results regarding the possible modulatory action of qigong on cortisol (Park *et al*., 2014). Likewise, while several studies have shown significant effects in ACTH levels, recent works have reported an absence of such changes (Chen *et al*., 2013; Hsieh *et al*., 2015; Hwang *et al*., 2013; Tsang *et al*., 2013). With respect to DHEA-S levels, among the few existing studies researching other oriental psychosomatic methods, some of them coincide with results from our work (Carlson, Speca, Patel & Goodey, 2004; Vera *et al*., 2009). Other studies, however, significant changes have reported (Chatterjee & Mondal, 2014; Glaser, Brind, Vogelman *et al*., 1992; Walton, Pugh, Gelderloos & Macrae, 1995).

Some of the aforementioned contradictory results found in the literature could be due to differences in the time interval elapsed between the last training session and the sample collection, and/or to the duration of the different training programs used. Our results revealed a significant reduction on ACTH levels twenty-four hours after the last session; however, we have not found significant changes on the activity of the HPA axis one hour after the last training (data not published here). These results seem to suggest, therefore, that the specific effect of Taoist qigong practice on ACTH can be sensitive to the time factor. Thus, this time sensitivity could account for the lack of changes immediately after the last training session, while a modulatory action can be observed on ACTH levels twenty-four hours after it.

A short-term duration of intervention (1 month) was used in our work; thus, the long-term effects of Taoist qigong still remain unknown. In this sense, a longer training program would provide additional information about the modulatory influence of this method on the HPA axis activity. In previous research, using yoga, another Eastern psychosomatic method, we found a significant effect on the levels of cortisol in long-term practitioners, whereas no significant differences were shown in ACTH and DHEA-S (Vera *et al*., 2009). Another possible explanation, of physiological nature, for the different and contradictory results found in literature, might be related with the temporal lag between changes in ACTH and in corticosteroid levels (Bornstein, Engeland, Ehrhart-Bornstein & Herman, 2008). Thus, it is likely that the timing and frequency of sampling in studies reflect different times on the ACTH-corticosteroids relationship.

It has long been proposed that any association between well-being and physical health status is presumably mediated by physiological mechanisms, the main candidate being the HPA axis (Goel, Workman, Lee, Innala & Viau, 2014; Langelaan, Bakker, Schaufeli, van Rhenen & van Doornen, 2006). In fact, more recently, it has been suggested that the HPA axis modulation by therapeutic interventions may have a role in disease treatment and prevention (Ryan *et al*., 2016). In this sense, the significant decline observed in ACTH levels, a hormonal component of the HPA axis, after Taoist qigong practice seems to invite us to glimpse interesting clinical implications of this method, implications that suggest that this qigong system could constitute an useful complementary tool in the therapeutic field.

A reduction of HPA axis activity has been also related with positive changes in mood regulation and psychological well-being after qigong practice (Chow, Dorcas & Siu, 2012). In our study, however, the reduction in blood ACTH levels was not accompanied by any changes in psychological well-being measures, such as anxiety and depression symptoms, and subjective sleep quality. It is possible that one month of qigong training might not be enough to find significant effects on psychological variables, similar to that observed on cortisol and DHEA-S levels, which no changes were also shown. Therefore, it could be interesting to study the influence of a longer period time of qigong on these psychobiological parameters. On the other hand, the nature of our sample might have made it difficult to obtain variations in psychological measures. Thus, the lack of significant changes observed in anxiety and depression symptoms, and subjective sleep quality measures may also be due to the fact that experimental and control groups were healthy voluntary participants with no previous overall mood and sleep disturbances. In this sense, future research should assess other outcome measures related to overall psychological wellbeing. Nevertheless, it must be pointed out that anxiety and depression symptoms are interesting features to investigate even in healthy subjects, given that there is a range of normal, and, even within this normal range, statistically significant differences could have been found between groups.

In this exploratory research, the control group was just required to keep their usual lifestyle pattern during the study period. The group was designed in this manner so as to have a simple, direct, and clear comparison of the effects of qigong on the experimental subjects. In future studies, it would be interesting to use other control conditions (active control, for instance) to gain more knowledge about the reach of the effects of Taoist qigong.

Finally, the size of the sample, which consisted only of university students and the relatively short period of study could be considered, to a certain extent, as a limitation of our overall results. Further studies should explore the effects of long-term qigong training on endocrine function and psychological well-being using a larger and more diverse sample. It would be also interesting and necessary to include different time points per day for blood measures. This would certainly provide a broader perspective and a better understanding of the nature of the effects induced by Taoist qigong on HPA axis.

In summary, the present work represents a first attempt to explore the impact of a particular qigong method, Taoist qigong, on specific endocrine parameters and psychological well-being. The decrease on blood ACTH levels found in the qigong group reflects a significant modulatory action on HPA axis function which might have interesting clinical implications. Therefore, we conclude that it is necessary to further explore the psychobiological modulation of this specific qigong method and its possible repercussion for human health care.

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