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**THE INFLUENCE OF QIGONG ON ADOLESCENTS`
ATTENTION:**

A Prospective Randomized Placebo Controlled Trial

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Dissertação de Mestrado em Medicina Tradicional Chinesa

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A Prospective Randomized Placebo Controlled Trial

Dissertação de Candidatura ao Grau de Mestre em Medicina Tradicional Chinesa submetida ao Instituto de Ciências Biomédicas Abel Salazar da Universidade do Porto.

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Resumo

Introdução: *Qigong* é um sistema de exercícios da Medicina Tradicional Chinesa que pode ser considerado como uma terapia tradicional de retorno neurovegetativo. O exercício chamado "Bola Branca" (*White Ball Qigong, WBQ*) demora apenas 2x5 minutos por dia e, segundo estudos prévios, revelou reduzir a ansiedade, os sinais de burnout e de outras síndromes como exaustão emocional e despersonalização.

A capacidade para direcionar e manter a atenção é um pré-requisito para a aprendizagem e a falta de atenção pode afetar o desempenho escolar, um problema cuja solução está longe de ser encontrada.

Os exercícios de *Qigong* são utilizados frequentemente em diversos países desenvolvidos como método de incremento da capacidade de atenção e memória dos estudantes. No entanto, até hoje, não foi encontrado qualquer estudo científico sobre os efeitos do *Qigong* na atenção.

Objetivos: 1) Avaliar o efeito do *WBQ* nos níveis de atenção em adolescentes (12-14 anos), em contexto escolar; 2) Fundamentar a aplicação de técnicas de *Qigong* bem como a eficácia do exercício específico de *Qigong* ("Bola Branca") no aumento da atenção; 3) Demonstrar a viabilidade desta terapia no contexto diário da vida escolar.

Métodos: Estudo prospetivo, randomizado com controlo placebo. Para o efeito foi criado um grupo especial "*Qigong* placebo" (GQP) para servir de controlo. Foram recrutados $N=66$ adolescentes pertencentes a 3 turmas do oitavo ano, durante um ano escolar. As três turmas foram organizadas em: grupo *verum* (GV; $n=22$), grupo de controlo (*Qigong* placebo) (GQP; $n=22$) e grupo de lista de espera (GLE; $n=22$) após assinarem o consentimento informado, de acordo com a declaração de Helsínquia. Nenhum participante tinha qualquer experiência prévia com *Qigong*.

Intervenção: O GV e o GQP receberam treino nos exercícios indicados com uma duração de 5 minutos, no final das aulas de Educação Física, duas vezes por semana. Ambos os grupos foram encorajados a realizar os exercícios diariamente em casa. Questionados duas vezes por semana, verificou-se que a frequência dos exercícios realizados em casa era estatisticamente igual em ambos os grupos.

O GQP consistia em permanecer em posição ortostática basal tradicional do *Qigong* enquanto assistiam a um programa de televisão do seu agrado. Os estudantes

foram informados que esta atividade era uma forma válida de promover a atenção. O grupo da lista de espera, não sofreu qualquer intervenção.

O Teste Atenção (D₂) foi aplicado antes dos exercícios (t₁, pré-teste) e após duas e quatro semanas (t₂, pós-teste; t₃, seguimento). Este teste mede: Total de Caracteres Processados (TC); Total de Acertos (TA); Total de Eficácia (TC-E); Índice de Concentração (IC) e Índice de Variabilidade (IV).

Resultados: Em t₁, não houve diferenças significativas entre os 3 grupos nos 5 parâmetros avaliados. Em t₃, o GV apresentou resultados significativos nos 5 parâmetros avaliados comparativamente com o GQP e o GLE: TC ($p= 0,000$), TA ($p= 0,000$) TC-E ($p=0,023$), IC ($p=0,004$) e IV ($p=0,003$). Os valores do GLE foram no geral inferiores aos do grupo de GQP, no entanto não houve diferenças estatisticamente significativas entre ambos, indicando um fraco efeito do GQP em relação ao GLE.

Discussão: Um dos principais problemas dos estudos de *Qigong* é a seleção de métodos de controlo adequados. Este estudo foi o primeiro a avaliar os efeitos do *Qigong* com recurso a um grupo de controlo (GQP).

Conclusão: Os resultados fundamentam a hipótese de que o *Qigong* pode influenciar positivamente os níveis de atenção. De acordo com o nosso estudo, o *Qigong* incrementou os níveis de atenção dos estudantes e pode ser recomendado para o aumento da atenção, apresentando-se como uma medida fiável e acessível sem revelar efeitos secundários. Futuramente será conveniente examinar os efeitos a longo prazo num estudo longitudinal com um maior número de participantes.

Palavras-chave: Medicina Tradicional Chinesa, *Qigong*, efeitos do *Qigong*, benefícios do *Qigong*, *Chi Kung*, Atenção, Teste D₂, "Bola Branca".

Abstract

Background: *Qigong* is an exercise system of Traditional Chinese Medicine that may be regarded as a neurovegetative biofeedback therapy. The so-called *White Ball* exercise takes only 2x5 min per day and, according to previous studies, was shown to reduce anxiety, signs of burnout and other syndromes such as emotional exhaustion and depersonalization.

The ability to direct and maintain attention is a prerequisite for learning, and a lack of attention may affect school performance, a problem for which a solution is far from being found.

Qigong exercises are already common in many developed countries as to increase attention and memory capacity. However, to the best of our knowledge, there are no scientific data showing an effect of *Qigong* on attention at all.

Objectives: 1) To evaluate the effects of *White Ball Qigong* on attention levels of adolescents (12-14 years) at school; 2) To substantiate the use of *Qigong* techniques as well as to assess the effectiveness of a specific *Qigong* exercise (*White Ball*) in the increase of attention; 3) To demonstrate the feasibility of such training in the context of everyday's school life.

Methods: A prospective, randomized, placebo and controlled trial was carried out in a parallel group design. For this purpose a special control group (placebo *Qigong*) was developed to serve as a control. $N=66$ adolescents of three classes attending the eighth highschool grade were recruited (one complete highschool year). The three classes were randomly allocated to a *verum* group ($n=22$), control group (placebo *Qigong*) ($n=22$) and waiting list group ($n=22$) after written consent according to the Helsinki declaration. No participant ever had any previous experience in *Qigong*.

Intervention: *Verum* and control group (placebo *Qigong*) received training in the exercises with a duration of 5 minutes at the end of the Physical Education lessons 2x/week. Both groups were encouraged to repeat the exercises daily at home. Interviews twice a week revealed that the exercise frequency was statistically equal in both groups.

Control group (placebo *Qigong*) consisted of a *standing* position while watching a television program of their choice. Students were informed that this activity was a valid way to improve their attention.

The waiting list group was left without any intervention.

Attention Tests (D₂) were applied before the exercises (t1, pre-test), and after two and four weeks (t2, post-test and t3, follow-up). This test measures: Total Number of Items Processed (TN); Total Hits (TH); Total Number of Items Minus Error Scores (TN-E); Concentration Performance (CP) and Fluctuation Rate (FR).

Results: At t1, there was no significant difference between the 3 groups in all 5 measurable features. At t3, the *verum* group was significantly superior in all 5 measurable features in comparison to the control group (placebo *Qigong*) and waiting list group. *p* values differed for TN (*p*= 0,000), TH (*p*= 0,000) TN-E (*p*=0,023), CP (*p*=0,004), and FR (*p*=0,003). Values in the waiting list group were generally worse than in the control group (placebo *Qigong*), but there was no significant difference between control group (placebo *Qigong*) and waiting list group, indicating a relatively low effect in comparison of the group with no intervention.

Discussion: One of the main problems of *Qigong* studies is a buildup of adequate methods of control. To the best of our knowledge, this study was the first placebo-controlled *Qigong* study to evaluate *Qigong* effects.

Conclusion: The results are consistent with the hypothesis that *Qigong* can positively influence levels of attention. According to our study, *Qigong* may increase the attention levels of the students and can be recommended to improve attention as feasible and cheap measure showing no side effects.

In future, it would be useful to examine long-term effects in a longitudinal study with even more participants.

Key words: Traditional Chinese Medicine, *Qigong*, *Qigong* effects, *Qigong* benefits, *Chi Kung*, Attention, Test D₂, *White Ball*.

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Abbreviations

ACTH - Adrenocorticotrophic Hormone

CP - Concentration Performance

EADS-C - Anxiety, depression and stress scale for children by Lovibond and Lovibond

FR - Fluctuation Rate

GLE - Grupo Lista de Espera

GPA's - Average measurements of academic performance of the students to apply for university, calculated by dividing the total number of grade points received by the total number of credits

GQP - Grupo *Qigong* Placebo

GV - Grupo *Verum*

HDAD - Hyperactivity Disorder and Attention Deficit

MBI - Questionnaire Maslach Burnout Inventory

QOL - Quality Of Life

QP - *Qigong* Placebo

TCM - Traditional Chinese Medicine

SCL-90-R - Symptom Checklist – 90 – Revised questionnaire

SPSS - Statistical Package for the Social Sciences

TH - Total Hits

TN - Total Number of Items Processed

TN-E - Total Number of Items Minus Error Scores

WBQ - *White Ball Qigong*

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"What is seen by a generation as the apex of knowledge, is often seen absurd by the next, and what a century considers a superstition can be the foundation of a science in the following century. "

Paracelso

Introduction

The choice of this study's theme results from identifying the lack of attention shown by the students as one of the greatest problems of the teaching/learning process.

The present document is a thesis proposal within the framework of the Master degree of Traditional Chinese Medicine, lectured in the Institute of Biomedical Science of Abel Salazar – Oporto University, under the supervision of Prof. Henry Johannes Greten and co-supervision of Prof. Jorge Machado and *Qigong* Specialist Mário Gonçalves.

For thousands of years people in China have practised a system of exercises known as *Qigong*, to improve their physical and mental health (Brecher, 2007).

Although it is used by millions of people, scientific evidence related with the effects of *Qigong* still have some restraints, which are:

1. The effects are hardly objective: The studies on *Qigong* are not always up to scientific standards, due to mistakes in evaluation or lack of control. To avoid this situation we used the D₂ - Attention test, which is reliable and valid to measure the selective attention. (Brickenkamp & Zilmer, 2007:10).
2. The methods of *Qigong* are not properly or uniformly defined: The directions of the exercises are only seldom assigned to western diagnosis and some details are not thoroughly explained. In fact, *Qigong* is not the same as *Qigong* as there are more than 1000 manners officially taught. (Li, Chen & Mo, 2002). Thus, we decided to use the specific exercise *White Ball*, following the work by Saganha *et al.*, 2012; Sousa *et al.*, 2012; Matos *et al.*, 2012.
3. Insufficient control: To reduce this restraint, three control groups were determined: *verum* group, control group (placebo *Qigong*) and waiting list group.

The main purpose of this study is to evaluate the effect of *Qigong (White Ball)* on attention levels of adolescents aged between 12 and 14 years old, in a school context. Simultaneously, it intends to demonstrate the feasibility of integrating these exercises in physical education classes.

We also the attempt to assess if and how the effects related with *Qigong* can be made objective through psychological score. This task proved to be very hard, since it is fundamental that the students take these exercises seriously and perform them correctly.

1. State of Art – Literature Review

To be able to understand the state of art about attention, *Qigong* and the relationship between them, we performed a comprehensive literature review. The criteria used for inclusion of articles for this literature review were: databases, such as b-on, Pubmed, Science Direct, EBCs host, Google scholar and databases in psychology Walter Kluwer Health Ovid SP. For this purpose, we used the keywords: Traditional Chinese Medicine, *Qigong*, *Qigong* effects, benefits of *Qigong*, *Chi Kung*, Attention and D₂.

1.1. *Qigong* Concept

Eastern medicine models like *Qigong* are gaining the attention of western medicine in the last years (Greten, 2008) because of their treatment effectiveness and explanation for the "immeasurable reality" of psychosomatic diseases and other physical complaints that western medicine seems to hardly explain by means of their organic and measurement devices.

Gonçalves (2010) states that *Qigong* gathers the three great treasures of Traditional Chinese Medicine: *Qi*, *Shen* e *Jing*.

According to the Heidelberg model, *Qi* is the vegetative capacity to function of a tissue or organ which may cause the sensation of pressure, tearing or flowing. *Shen* is a functional capacity to put order into mental associativeness and emotions, thus creating mental presence and *Jing* is the term of potential structure (Greten, 2007).

The first book with information about *Qigong* "The Classic internal Medicine of the yellow Emperor" was written in 700 BC (Unschuld & Tessenow, 2011). It combined several breathing and stretching exercises and mental visualizations that kept people healthy. The exercise of *Qigong* is "profoundly individual, based in the consciousness of the practitioner." It is "at the same time a physical and mental participation, resulting in intensified vital activity" (Landsman, 2005:43).

This exercise can be briefly described as "a set of exercises and body movements which aim at fighting or preventing certain diseases from the perspective of prolonging life and the maintenance of good health" (Dong, 2007:9). From a western standpoint, *Qigong*

can be considered a meditative (concentrative) system of motion and breathing exercises. By vegetative sedation, it may act on the practitioner in the sense of a self-regulating therapy. It does not need any drugs, neither a therapist, once the exercises have been learnt, and moreover it is not considered to have side effects or show the risk of addiction (Greten, 2007).

Besides incorporating the practice of physical activity, including exercises of body movement combined with breathing and mental exercises, *Qigong* is part of the ancient Chinese culture and of the philosophy of TCM, looking for a holistic coherence and promoting the work of the body, and mind at the same time. Therefore, practicing *Qigong* contributes to the total balance of our organism (Barroso, 2009). The continued practice of *Qigong* strengthens the body and increases resistance to disease (Ding, 1996:9).

To sum up, *Qigong* is a therapeutic method of TCM that combines slow, gentle movements with breathing control, and a specific mental state of "consciousness and imagination" (Matos *et al.*, 2012:663).

1.2 Effects of *Qigong*

Several studies were conducted at nacional and internacional levels to ascertain the physiological effects of *Qigong*.

"Recent research found that *Qigong* might have some potential health benefits and biological effects" (Matos *et al.*, 2012; Sousa *et al.*, 2012; Barrow *et al.*, 2007; Skoglund & Jansson, 2007; Chang *et al.*, 2008; Saganha *et al.*, 2012; Chen *et al.*, 2013).

Matos *et al.* (2012) examined two individuals with prior experience of *Qigong* through infrared thermography in order to assess their ability to change the skin microcirculation. Measurements were made at different body points to check the electrical potential difference and the thermographic changes of this therapeutic method.

Sousa and Matos have tested the relationship between the practice of *Qigong* and the anxiety in musical auditions in children aged between 7 and 12. In addition to physiological measurements in this study, we evaluated the effects of the exercises by infrared thermography of the hands at the beginning and at the end of the seven-week

training programme. The results showed that there were changes in local microcirculation during the exercises, which can explain the change in the temperature of the skin, checked in the study by Sousa, when the *White Ball* exercise is performed. In both studies there were changes in the electrical potential of the points (Matos *et al.*, 2012; Sousa *et al.*, 2012).

The results of this work have demonstrated that *Qigong* reduces:

- . The subjective perception of anxiety (measured by EADS-C);
- . Heart rate;
- . Blood pressure;
- . Levels of salivary cortisol.

In a study which aimed at assessing the influence of *Qigong* in the quality of life and key-symptoms of chemotherapy tested in patients with breast cancer. It was notice improvement in symptoms, although they weren't statistically relevant in the *Qigong* group. However, in the control group, every symptom worsened in a statistically important way. In the assessment of the amplitude of movement of the shoulder on the side of the affected breast, both groups showed changes in mobility and pain. There was a significant improvement in the *Qigong* group ($p=0,008$), compared with the control group (Fernandes *et al.*, 2011).

Saganha *et al.* (2012) conducted a study to evaluate the prevalence of burnout among physical therapists, and assess whether the *Qigong White Ball* exercise was effective in opposing burnout. Thus, physical therapists filled in a demographic questionnaire and the questionnaire Maslach Burnout Inventory (MBI). The intervention group performed a specific *Qigong* intervention developed by Heidelberg School of Chinese Medicine. At the end of a three week period of treatment, the results showed that the average values of the emotional exhaustion subscale in the intervention *Qigong* group decreased, while the values in the control group increased. The difference between the two groups was statistically significant ($p = 0,023$). *Qigong* reduced the average values of the depersonalization subscale, but in the control group the value increased. The difference between the groups was statistically significant ($p = 0,013$). In short, the effects of the *Qigong White Ball* exercise on the burnout symptoms are measurable with MBI.

The results confirm that this kind of *Qigong* is an effective tool for the self-management of burnout.

Barrow *et al.* (2007) studied the effects of *Qigong* in patients with heart failure. Patients who performed the exercises had an improvement in the scores of heart failure symptoms measured with the Minnesota Living with Heart Failure Questionnaire ($p = 0,01$), and also in the results of clinical depression measured with the Symptom Checklist-90-Revised questionnaire (SCL-90-R) ($p = 0,12$) compared to patients in the control group.

Skoglund & Jansson (2007) argue that the *Qigong* exercise may reduce stress in computer scientists. Their study revealed that with the practice of *Qigong* there was a reduction in the excretion of noradrenaline in urine ($p < 0,05$), which influenced the heart rate and temperature, indicating a reduced activity of the sympathetic nervous system. Furthermore, *Qigong* reduced the lumbar symptoms ($p < 0,05$).

Chang *et al.* (2008) demonstrated in a study involving 30 children that the practice of *Qigong* contributes to the improvement of the cardiorespiratory function in asthmatic children. 15 children practiced *Qigong* and 15 were in the control group. After the 12 week program, the children of the *Qigong* group showed a significant improvement in the pulmonary function compared with the control group.

Chen *et al.* (2013) investigated the effectiveness of *Qigong* in the quality of life of women with breast cancer, during and after the treatment. This study included 96 women with breast cancer who were recruited from a cancer center in Shanghai. 49 of these women performed *Qigong* exercises five times a week, during 5 or 6 weeks of radiotherapy. The results of Quality of Life (QOL) (i.e., clinical depression symptoms, fatigue, sleep disturbance and quality of life in general), were measured during the treatment, at the end of treatment, 1 month later and 3 months later. The results showed that women who performed *Qigong* had less clinical depression symptoms compared to women in the control group ($p = 0,05$). Women who had great clinical depression symptoms at the beginning of radiotherapy reported less fatigue ($p < 0,01$) and better overall quality of life ($p < 0,05$). These results indicate that *Qigong* can have therapeutic effects in women who are undergoing radiotherapy for breast cancer.

2. The Concept of Attention

Attention is based on a complex neuropsychological process which aims to facilitate mental activity through a selection of most relevant stimuli according to the needs of the body (Lopes *et al.*, 2010).

In the beginning, the definition of attention was studied by philosophers and later by psychologists, restricting only to the selective aspect, for example, certain activities rather than others.

James (1890:404), one of the first cognitive psychologists, defined attention as:

“Everyone knows what attention is. It is the mind taking possession, in clear and vivid way, of one of the various objects or series of thoughts which seem simultaneously possible”.

Rützel (1977:49) defines attention as a “selective process: the perception and the internal imagination are simultaneously directed, focused, fixed and concentrated to and on a specific stimulation, i.e. the content of thought and imagination”. This concept highlights the impossibility to dissociate the perception from the data processing in a dynamic way.

Magill (1984), also, considers that attention includes the study of alertness which implies preparing oneself to sensory information and maintaining alertness, and is also related to the idea that we have a limited ability to process information.

Restricted to the introspective method, it was only after the 1950's that the definition of attention became more complex, through the new experimental theories to analyze the treatment processes.

Subsequently, Schmidt (1993) relates the concept of attention with the "capabilities to process information that set the limit on human skilled performance" and highlights the following characteristics of attention:

- Attention is serialized, shifting from one source to another over time.

- The attention is limited in capabilities.
- The attention requires effort and is related with excitement.
- Attention limits the ability to do certain parts of the task at the same time.

Sternberg (2008), states that attention is the mind taking possession, in a clear and vivid way, of one of the various objects or series of thoughts which seem simultaneously possible and it implies the abandonment of some things in order to effectively deal with others.

However, Gall *cit in* Caldas (1999) states that "attention is a complex process which requires division in multiple operations. It is an integrant and fundamental part of sensory activity, vital to the memory and it participates as a distributor of sensory activity to the various consciousness levels that processes information simultaneously. "

Among the several definitions which can be taken into account, according to the specialty, it can be said that attention is responsible for the function of selecting certain stimuli instead of others (possibly accessing consciousness) and the selected stimuli facilitate perception, choice and the performance of adequate responses for the body (Doron & Parot, 2001).

According to Sims (2001:45) "Attention is the passive or active focusing [...] of consciousness on an experience" and Concentration is the act of keeping the focus of consciousness on an experience or task which is being performed.

Scharfetter (2002:143) defines attention as "the orientation (active or passive) of consciousness towards something which was experienced". And defines concentration as "the concentrated persistence of attention".

In general, attention is understood by Samulski (2002:80) "as a selective, intensive and directed state of perception." In this sense, perception relates to the "process of enjoying reality, but also the experience of the senses when receiving, understanding, transmitting information and, consequently, knowledge about himself and his specific

environment. This knowledge is a requisite for guidance in the possibilities and limits of an action, adapted to the situation" (Eberspächer, 1987:468, *cit in* Greco, 2002:57).

Attention is embodied in a complex neuropsychological process which has the function of facilitating mental activity selecting the most important stimuli, according to the body needs. Using the cognitive function to select the stimuli, the individual becomes capable of directing, maintaining or changing the focus of his attention. This process is called selective attention (Stella & Maciel, 2002).

The modern cognitive Psychology describes attention as the continuous process of filtering information from the perception of the environment and to focus on specific elements (Ashcraft, 2005; Goldstein, 2007). It is a human cognitive process in which information is gathered by the sensory organs (Bisley & Goldberg, 2005; Ashcraft, 2005; Gilbert & Sigman, 2007; Posner, 2004). Attention is the mechanism that acts as a filter to get this sensory information, so that the most important and relevant aspects of the environment can be processed quickly and effectively (Ashcraft, 2005; Goldstein, 2007).

Spinelli (2005:27) believes that "we decide, on any number of grounds, just what is and is not of significance in our experience."

Commonly, attention is considered an automatic task, in which the brain filters out irrelevant information, immediately and without conscious decision, automatically eliminating what would otherwise be overwhelming sensory stimulation (Ashcraft, 2005; Goldstein, 2007).

In this research, the concept of "attention" is defined as the process of allocation of the mental energy for a specific task. This definition assumes that there is a limited amount of cognitive resources that can be used for a task (Ashcraft, 2005; Goldstein, 2007; Posner, 2004).

2. 1 Types of attention

Konzag (1981) distinguishes between three types of attention: focused attention, divided attention and alternating attention:

Focused attention is the process of focus on a particular object or action, meaning, the ability to consciously direct attention to a specific point in the perception field. Focused attention is linked to the individual's ability to direct and to choose a single stimulus. This process is also known as Concentration (Samulski, 2002).

Is one of the different types of attention and is defined as the focusing of attention on a particular object or a given action.

Focused attention can be defined as the ability to select a source of information (stimuli from the environment or the internal world) from all which are available at a given time and to be able to direct the attention (stay focused) to the stimulus or task to be performed over time. Therefore, for any activity to be performed or an activity in which the individual engages it is necessary that he focuses his attention for a longer period of time, in order to facilitate the learning process, promoting the proper use and the quality of his work (Winter *et al.*, 2006).

Focused attention is also the ability to choose a certain stimulus over others, which are considered less relevant. This refers to the ability to maintain the focus of attention in a stimulus during a given period, and to react immediately before the detection of a specific stimulus (Gazzaniga & Heatherton, 2005).

Divided attention is the distribution of concentration on various objects. The intensity of divided attention is minor compared to focused attention, because several objects and actions are simultaneously observed.

Finally, alternating attention is the ability to perform two or more tasks simultaneously, comprising the quick and comprises the quick and appropriate orientation to situations through a great adaptation of the direction, the intensity and the volume of attention, according to the demands of the environment.

In alternating attention it is possible to alternate the focus of attention, knowing that in alternating attentions there is the distribution of attentional resources into simultaneous tasks during the execution of independent tasks (Sternberg, 2008).

2. 2 Aspects which influence attention

Nowadays the effort of learning about attention is becoming bigger. When we try to describe how attention works, a great dispersion arises, resulting from the constant change of the focus of attention.

In modern society there is an excessive and fast speed information which leads to a constant change in the focus of attention, according to the incessant appeals.

In 1989, Cratty distinguished between some internal and external aspects which determine attention of internal and external aspects (Chart I), besides, there are other variables like: visual characteristics, activation levels, personality traits, difference in gender, time of day and learning level, which may influence the attention processes.

Internal aspects	External aspects
<ul style="list-style-type: none"> • Sensory system (visual and hearing systems) • Capability of processing information • Behaviour learnt in specific situations • Personality traits 	<ul style="list-style-type: none"> • Amount of information • Social stress • Complexity of stimuli

Chart I Internal and external aspects which interfere in the attention process.

Source: Cratty, 1989:93

In our study, we will specifically look into the relationship between activation, attention and performance, besides the general conceptions of the learning level.

Nowadays, several studies have demonstrated that the factors which influence attention are wider than those which Cratty described. Thus, attention is influenced by: aspects related with lifestyle, such as the amount and quality of sleep (Taras & Potts-Datema, 2005; Noland, Price, Drake & Telljohann, 2009), the stress level (Braunstein-Bercovitz, 2003; Bartholow *et al.*, 2003), anxiety (Sousa, 2011) and the amount and type of physical exercise (Budde *et al.*, 2008).

Then, we report the way in which those variables affect attention.

2.2.1 Sleep and attention

Taras & Potts-Datema (2005) carried out a study on how sleep affects the academic performance of students between 5 and 18 years old. The researchers collected data from several studies that recorded student's GPAs and their attention when performing cognitive tasks. The sum of the results of 21 studies over the past 10 years led the researchers to assume that suboptimal sleep (short, of erratic quality, poor, and / or lack of) adversely affects the student's ability to learn and his school performance in general. Therefore, the quality of sleep reflects on the child's or youngster's attention and his school performance.

Noland, Price, Drake & Telljohann (2009) found that stress, caffeine, alcohol, exercise, work, homework and time management skills are aspects that affect the quality and quantity of sleep.

Some of these aspects were also found to affect attention, such as stress (Braunstein-Bercovitz, 2003), alcohol consumption (Bartholow *et al.*, 2003), and exercise (Budde *et al.*, 2008). More specifically, sleep-deprived participants reported a decrease in attention, academic performance, concentration and depression. (Taras & Potts-Datema, 2005; Curcio, Ferrara & DeGennaro, 2006; Wolfson & Carskadon, 2003).

Noland, Price, Drake & Telljohann (2009), examined the sleep patterns and perceptions of 384 middle school students. The study revealed a statistically significant correlation between the lowest levels of sleep and the highest levels of stress.

2.2.2 Stress and attention

Stress is another aspect which significantly influences attention. A study conducted by Braunstein-Bercovitz (2003) examined the relationship between stress and selective attention. Specifically, this research involved 40 random participants, aged 18-31, mostly first year Psychology students in two groups: the high stress group and the low stress group. When the groups were compared based on their mistakes and response time, it was found that selective attention was adversely affected by stress. The participants from

the high stress group had lower performance levels in the selective attention test compared with the low stress group. Based on these results, Braunstein-Bercovitz (2003) states that stress impair the ability to distinguish between various stimuli, increasing the amount of attention given to distractions. These results are contested in the literature by studies which observed an improvement in selective attention after inducing stress (Chajut & Algom, 2003).

Chajut & Algom (2003) conducted an experiment with 160 participants, aged 20-25 years, who were divided into four equal groups. All individuals were subject to tasks designed to induce stress due to the difficulty of the problems, time constraints, and tensions for the participant's ego, including some insoluble questions. Each group also completed a computerized version of the Stroop Test, a timed test that measures selective attention. Reaction times were compared between groups by an analysis of variance (ANOVA) to measure performance. It was found that the ability of participants to selectively concentrate was improved by the presence of stress.

Sousa (2011) considers that when anxiety is a negative emotion, it is often accompanied by changes in cognitive processing. There is often an attention deficit when individuals have to deal with the threat or stressful situations (Fales *et al.*, 2008).

According to Wilson, Smith and Holmes (2007) there are two theories that explain the relationship between anxiety and performance: the conscious processing hypothesis (Masters, 1992) and the processing efficiency theory (Eysenck & Calvo, 1992). The conscious processing hypothesis (Masters, 1992) suggests that stress situations increase anxiety and self-consciousness about performing successfully. This heightened self-consciousness causes a breakdown of automated movement units into a more consciously controlled sequence of smaller separated units. This process slows the performance and creates opportunity for error at each transition between units. The processing efficiency theory predicts that cognitive anxiety, in the form of concern, reduces processing and storage of the capacity of working memory, reducing the resources available for a given task. This theory also proposes that preoccupation causes a diversion of attention from tasks.

Although the literature is not conclusive about the relationship between stress and attention, the research demonstrates that there is a correlation (Bercovitz-Braunstein,

2003; Chajut & Algom, 2003) which depends on the stress level and on the number of tasks which must be completed.

According to Jouper & Hassmén (2008), individuals who regularly practice *Qigong* are more motivated, less stressed and more focused during the exercise than those who do not adhere to a regular practice.

2.2.3 Alcohol and attention

Several studies have shown that alcohol consumption can dramatically affect the cognitive processes of an individual. Parsons & Nixon (1998) have reviewed the literature and found a clear correlation between the amount of alcohol that an individual consumes daily over a period of time and the deterioration in cognitive functions.

For example, research suggests that individuals who consume 7-9 drinks per day for extended periods of time will experience mild cognitive impairment. Similarly, those who consume 10 or more drinks per day over the same period of time showed cognitive impairment, representative of the conditions found in alcoholics (Parsons & Nixon, 1998).

A research by Bartholow *et al.* (2003) analyzed the impact of alcohol on attention and on response inhibition in healthy young adults aged between 21 and 30. Participants consumed one of three fixed amounts of alcohol characterized as a placebo, moderate or high dose level. Participants then completed a derivation of Erikson "flanker task" which consisted in distinguishing whether a target card which appeared in the center of a five letter unit was compatible or incompatible with the card to his left or right. The individuals who performed the task were ranked according to reaction time and accuracy. The results of the study showed that the selection response and execution are more sensitive to the acute effects of alcohol than the processes of controlling attention. These results show that alcohol has an impact on cognitive functions, interfering with response processing.

According to a research made by Abroms, Gottlob & Fillmore (2006), the automatic cognitive processes such as selective attention are affected after the consumption of a moderate amount of alcohol, which has been tested with twelve adult participants after consuming three alcoholic beverages together with intervals of standard level of absolute

alcohol in each one, it showed that the cognitive functions, including attention, are sensitive to the effects of alcohol consumption.

2.2.4 Drugs and attention

Some studies have demonstrated that other substances, such as legal and illegal drugs, are also capable of having considerable influence on the attention and other cognitive processes.

Lundqvist (2005) compares the effects of cannabis, stimulants and heroin on attention, memory and executive functions. He went over the literature and discovered that cannabis causes cognitive impairment of memory, as well as of the attention/executive system. This is clearly visible during the intoxication and it is suspected to have long-term effects as well. People who take ecstasy and other illegal drugs suffer from memory loss, are more easily distracted, and are less efficient in focusing the attention on complex tasks.

In short, the several mentioned studies have demonstrated that high levels of stress, alcohol, drug taking and lack of sleep all affect the cognitive functions, including attention.

2.3 TCM and attention

Generally speaking, attention denotes the mechanism that assesses the importance of several stimuli and selects the one which will receive the focus of the brain (Higgins & George, 2012).

This implies a constant interaction of the limbic system, brainstem and the neocortex, relating the internal and external stimulation for a good interaction of the individual with the environment (Campiglia, 2009).

In terms of TCM attention is generated by directing the senses and mind to a target by some functional power called *Shen*. This term refers to a special *Qi* generated by the cardiac orb (the “heart”) as by reducing over-associativity and distracting emotional imbalances and ambivalances (Greten, 2013).

From the cognitive point of view, focused attention lies in the activity of the cerebral cortex and is related with higher brain functions which in terms of TCM are connected to by what in TCM is called *Shen* (Greten, 2007; Sá, 2009).

This is the functional ability to establish, put order to emotional movements and their balance as well as to the associative process, thus creating “mental presence”. *Shen* is the guiding and organizing instance in a context of the body-mind concept of TCM (Greten, 2007).

Shen is a special kind of functional capacity or energy that originates from the cardiac orb, and expresses the need of limitation of the emotions and associations (Greten, 2012).

The *Shen* is derived from the cardiac orb (“hearth”) and is a part of a complex network of interacting emotional and behavioral movements of the so-called phases. There, it acts as the inner “principal” within an inner dialogue and balance with the “counterweight” of the mindwill *Zhi* derived from genetic and substantial matter (renal orb, “kidney”).

It is also reigning the delicate balance of the *Hun* (animus, an unquiet “Wandering soul”), a mental aspect of the hepatic orb creating an controlling mental and behavioral impulsivity.

The counterplayer of this *Hun* is considered to be *Po* the “embodied soul” which analogous to the odem of life in Christianity brings *Qi* and life into the body substance *Yin* by the action of the pulmonary orb (the “lung”) by the breath. In so far, the body brought to life by breathing, receives functional, awakening impulse by the *Hun* (“liver”) as a mental process to be controlled as to avoid inappropriate impulsivity and irritability.

The *Yi* (the “one-ness”) of the phases earth finally provides coherence and balance, the ability to assimilate and develop logical thoughts by the lineal orb (“spleen”), interacting with the sensory apparatus (“hearth”, *Shen*) (Greten, 2013).

Thereby *Yi* of the “spleen” gives shape to inspiration and creativity as its function is to collect and process information a capacity linked to the generation of ideas in a specific

field. This leads to confidence, allowing the individual to clarify ideas, “think”, contemplate and focus (Greten, 2013; Campiglia, 2009; Hicks, Hicks & Mole, 2007).

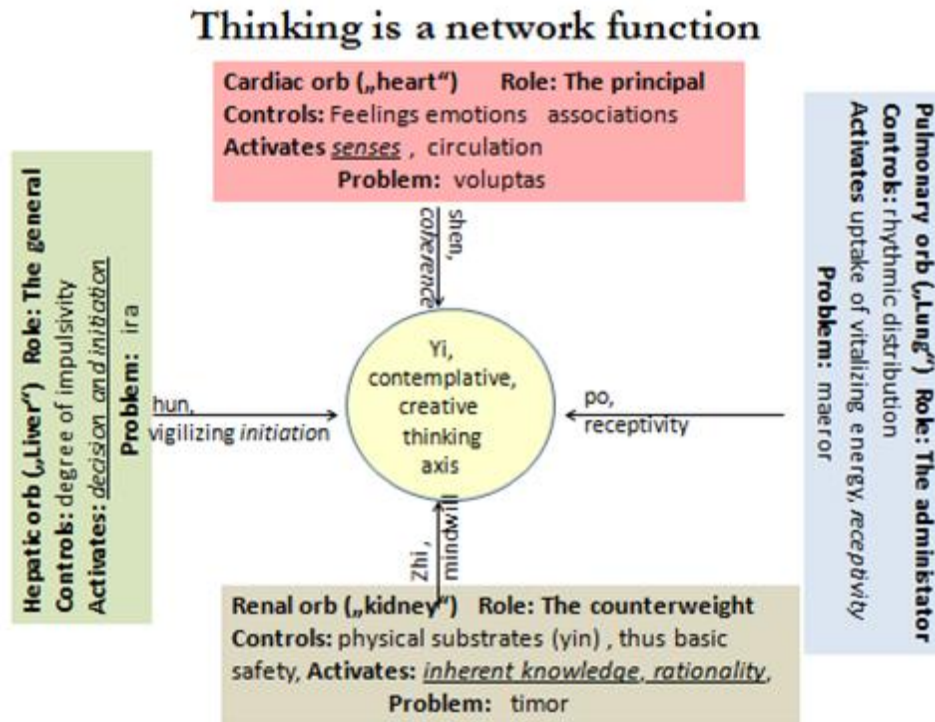


Illustration I Thinking in TCM a network of functions

Source: Greten, 2013

2.3.1 Qigong and attention

Through the analysis of various scientific articles it has been found that there are no studies which directly relate the practice of *Qigong* to attention in a school environment; that is why this is considered a prospective randomized placebo controlled trial.

Below, we mention two studies that focused on children in a school environment.

Witt *et al.* (2005) evaluated the effects of *Qigong* lessons in school environment, in terms of their achievements at school, social behavior and general health. They considered the feasibility of integrating *Qigong* in school lessons. Six months after starting

Qigong lessons, schoolchildren improved their social behavior and inappropriate behavior decreased.

Hillman, Erickson & Kramer (2005) analyzed the impact of physical activity on cognitive functions in schoolchildren (ages between 4 and 18). The children were assessed in their perception abilities, their intelligence quotient, their performance in verbal tests, mathematics tests, memory tests and their readiness in academic/development level. All of these areas, except for memory, revealed a positive correlation with physical activity, showing that an increase in physical activity led to a better cognitive and academic performance. This tendency persisted in every age group, although the correlations tend to be stronger in the age groups between 4 and 7 and between 11 and 13 years old than in the age groups between 8 and 10 and between 14 to 18 years old.

3. Study design

3.1 Investigation question and aim of the study

Investigation question:

- Does the continuous practice of *Qigong* exercises influence attention levels in adolescents aged between 12 and 14 years old?

Aim of the study:

- Assess the potential of *Qigong* as a therapeutic method to increase attention levels in adolescents in school environment.
- Identify the *White Ball Qigong* exercise and its influence in the increase of attention in adolescents.

3.2 Objectives

- To evaluate if and how *Qigong* related effects may be objectified by psychological scores using D₂ - Attention test;
- To add knowledge about the potential of *Qigong* techniques as a preventive or therapeutic method to the development of attention levels in adolescent students.
- To assess the efficiency of the specific *Qigong* exercise entitled *White Ball* in the increase of attention in adolescent students.
- To assess the feasibility of integrating *Qigong* in Physical Education lesson plans or another school subject.

4. Methods

A prospective, randomized, placebo, controlled trial with a parallel group design.

4.1 Recruitment

All (three) eighth year classes were recruited from the school E.B. 2,3 de Arões. After the approval of the managing organs of the school head-quarters, parents and adolescents were contacted by the researchers to integrate the study. Parents and adolescents who fitted the inclusion criteria were invited to a meeting in which they were informed about the aims of the study. However, the procedures were not revealed to avoid influence on the results. After signing the informed consent, the participants and their representatives, the control group, the waiting list group and the *verum* group (*Qigong*) were defined by means of sortation.

4.1.1 Inclusion criteria

Conditions for inclusion in this study were: eighth-grade students, aged between 12 and 14 years, of the School EB 2,3 Arões (Fafe), able to follow the instructions required to practice *Qigong*, after authorization of the parents and the students themselves, by signing a consent form.

4.1.2 Exclusion criteria

Students with hyperactivity disorder and attention deficit, or those who, even if they did not have a HDAD diagnosis, manifest symptoms of this disorder as well as students with previous experience in the practice of *Qigong*.

4.2 Intervention

This study integrated 66 teenagers attending the eighth-grade. We created three working groups: *verum* group (*Qigong*), control group (placebo *Qigong*) and a group without any intervention (waiting list group).

4.2.1 *Verum* group

The *verum* group consists in 22 adolescents who performed the *Qigong* exercises (*White Ball*) twice a week, over a 4 week period. These exercises took place at the end of Physical Education classes with the duration of 5 minutes. They were also encouraged to repeat the exercises daily at home.

4.2.2 Control groups

Parallel to the *verum* group, and in order to be able to compare the results obtained in this group later, there were also two other control groups. The first, called control group (placebo *Qigong*), also with 22 participants of both genders, aged between 12 and 14, the fake *Qigong* consisted of being in a *standing* position while watching a television program of their preference, for 5 minutes over 4 weeks, twice a week. The control group (placebo *Qigong*) was also instructed to do the exercises daily at home. They were led to believe that this activity was a valid way to improve attention.

The waiting list group, had also 22 adolescents, proceeded only to testing D_2 without any intervention. Prior to starting the study, all eighth grade classes, at the end of the Physical Education classes, took the D_2 - Attention test, which was previously explained to the students and applied by a qualified individual having jurisdiction and training in the submission and interpretation of psychometric tests. The qualified individual

was unaware of the exercises performed by each group. This test was applied at three different moments (T1=pre-test, T2=post-test and T3=follow-up).

4.2.2.1 *Qigong* exercises and their explanation

According to Heidelberg Model of Chinese Medicine, *Qigong* allows the practitioner, by imagination, motion, breath-control, to be more psychosomatically balanced. This process of subconscious self-regulation is programmed and learned. By a certain time, this balanced state may be neurologically conditioned, and remains in our vegetative nervous system, becomes part of our inner nature. The practitioner of *Qigong* will become more stable with challenge, resulting in a better quality of life (Greten, 2007).

The selected exercise of *Qigong* to do this study is *White Ball* and its main aspects are very well described by Greten (2007).

4.2.2.2 The *White Ball*

To do *Qigong* exercises *White Ball* it is required that the child in question do the following five steps (Greten, 2007).

1) Man between Heaven and Earth

Establishing the inner axis helps you to find your subconscious self by intuitive intelligence.

1. Feel the plumline of your body passing through the point Fons Scatens (R1) located on the bottom of your foot (Illustration II).

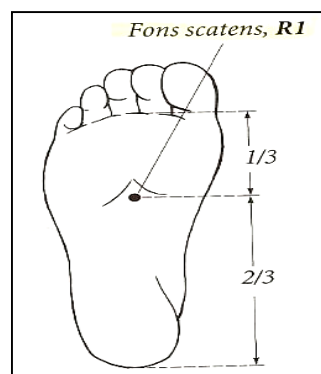


Illustration II R1 point (Fons scatenus)

Source: Porket & Hempen (1995:303)

- Put our back in a straight position
- Adjust your knees in order to lead the pumblineline to the point
- Adjust your whole posture by moving it slightly for – or backwards

2. Connect to the ground (earth)

- Connect RG20 (Conventus Omnium Yang), located on the top of your head (Illustration III) with the pumblineline

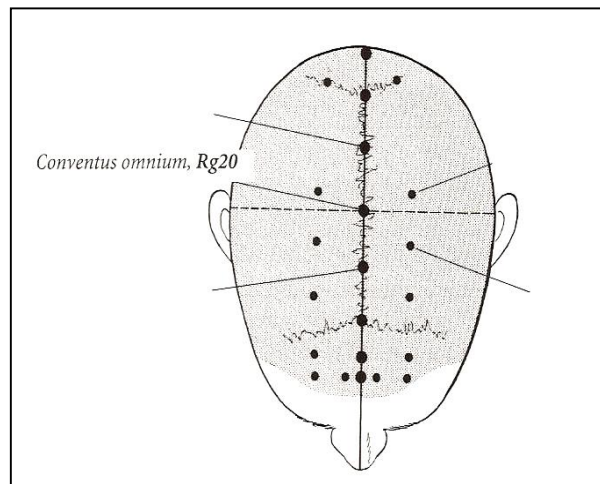


Illustration III Rg 20 Point (Conventus Omnium Yang)

Source: Porket & Hempen (1995:404)

- Feel the prolongation of this inner axis towards the center of the earth

3. Connect to the sky and heaven

- Adjust your whole body posture again
- Check de connection of RG20 and R1
- Check the connection to the earth before feeling the upward prolongation of the axis directed to the sky

II) The *White Ball* (Relax and purify the *Qi* flow)

- Close your eyes
- Hold your arms in the form of an arch
- Adjust the distance between your hands

- Breathe out 7 (for boys) or 8 (for girls) times, you feel the enhancement of flow

III) Feeding the Kidney Region (strengthen your substance)

- Close your eyes
- Relax your shoulders to enhance flow
- Welcome the warmth by opening yourself up to the flow
- Breathe out to enhance the *Qi* flow

IV) Closing the Girdle Conduit (close the surface to be protected)

- Slow down the movements of your hands
- Connect the point PC8 (Medium Palmae) by placing one hand over the other

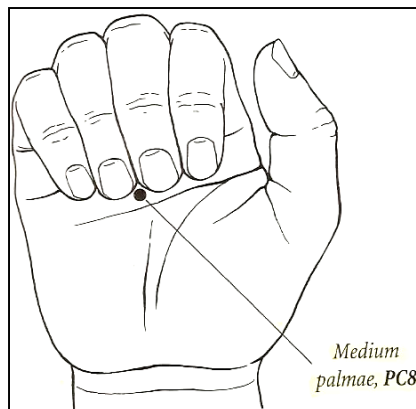


Illustration IV PC8 Point (Medium Palmae)

Source: Porket & Hempen (1995:329)

- Connect these two spots with the Dantian
- Relax your eyes by looking into the far

V) Thank the Principal (finding the appropriate relation to the world)

- Wrist bent perpendicular
- Rotate downwards
- Follow the downward movement with your whole body

4.3 Measurements

- D₂ - Attention test;
 - All students did the D₂ - Attention test.
 - All of the participants of the study followed the programme given to them. The conditions in the three moments of collecting data were the same.

4.3.1 D₂ - Attention test

D₂ - Attention test - This is one of the most popular neuro psychological instrument used to assess the attention of teenagers. This test is performed on a objective diagnosis and requires that participants have a quick and safe distinction between analogue details (Brickenkamp & Zilmer, 2007).

The D₂ - Attention test has a great importance especially because it measures attention, its faculty with a huge impact on intellectual, emotional and social functioning of human beings. In Germany this test was considered a standard instrument for the assessment of attention and concentration.

The task performed, requires the subject to mark a specific stimulation, it is regarded as a test of cancellation or blockage test.

The test takes approximately 8 minutes to administer and approximately 3 to 4 minutes to score. It is recommended to use in individuals 9 to 60 years old and can be used as part of an individual neuropsychological battery or administered in a group setting. Standardized instructions are provided for both adults and children.

The test is conveniently arranged on one sheet of paper. On the front are designated areas for demographic information and scores, as well as examples and a practice line for the examinee. On the reverse side of the paper there are the test stimuli, which consist of 14 lines, each with 47 characters (d or p with one to four dashes). Participants are allotted 20 seconds per line and are instructed to cross out each d that appears with two dashes in any combination above or below the letter (i.e., D₂). When 20 seconds has been reached, the patient is instructed to move on to the next line. This

continues until completion of all 14 lines of the test. Essential to this process is the ability to select relevant aspects of the task, while ignoring the most irrelevant this task should be performed quickly and accurately.

This test evaluates the speed, accuracy, quality of attention and the fluctuation in performance. (Annex 1 – data sheet).

This test also assesses visual attention aspects and, in a broader sense, the ability to concentrate (Brickenkamp & Zilmer, 2007).

In short, the D₂ - Attention test allows to measure two aspects of attention: the focused attention (with a selective and intensive nature) and the sustained attention (related to maintaining attention).

4.4 Statistical analysis

All dimensions of the D₂ - Attention test were statistically analysed, using the statistical program - Statistical Package for Social Sciences (SPSS - VERSION 20.0) to detect the statistical significance of the results.

According to Fortin (1999) the choice of the statistical test is preponderant and decisive in the analysis of the results; and the choice may be made for two types of tests: parametric and non-parametric tests. However, the decision for a type of test instead of the other was not made arbitrarily. Considering the size of our sample (22 adolescents in each group) and the independency in the observations, that is, the subjects did not affect each other and that the nature of the variables was with interval, the parametric test was selected as the best option (Martins, 2011).

The D₂ - Attention test was chosen to analyse the data, since it provides detailed information about the focused and selective attention in school context. D₂ - Attention test stands from other tests that assess this dimension because it has two appreciated characteristics in a psychological evaluation tool: the excellent metric qualities that reveal accurate, consistent and appropriate information for the evaluation of multiple aspects of attention and their conversion into a wide range of applications in schools (Steck, 1997).

Furthermore, it is a simple test and its application time does not exceed 10 minutes. As stated out in the technical manual of the D₂ - Attention test, the data was analysed by a psychologist with expertise in psychometrics and experience in integrated analysis of test results (Annex 2).

5. Ethical Consideration

In any research work it is essential to give importance to the methods of collecting data and the information that is chosen to be used (empirical phase of the study). Bogdan & Biklen (1994:75) states that "in research, ethics consists on the rules of the procedures considered correct and incorrect for a particular group."

These researchers synthesize the ethical principles in four basic aspects for quantitative researchers. These principles are fully respected, they are to protect the identity of participants (not to disclose information and avoid using political or personal information); It is to respect the subjects (using consent documents (written and audio-visual)); having realistic negotiation in the research (to achieve what is promised) and using authenticity when presenting the results.

All participants were informed about the study objectives and procedures. The data collected is completely anonymous and confidential, used only by the researcher and personal team. The right to self-determination was respected, since the participants and their legal representatives, as autonomous people that they are, were invited to participate in the study (Fortin, 1999), so their participation was completely voluntary. In order to maintain the ethical conduct in the research, Fortin (1999), after providing a description of the study, which does not constitute any risk to the health of the children, the consent documents were obtained from children and their legal representatives (Annex 3). On February 19, 2013, the Ethics Committee of the University of Oporto, approved the thesis proposal considering that all ethical principles were respected (Annex 4).

6. Results

6.1. Data

The sample involves 66 participants: 34 female (51,5%) and 32 (48,5%) males.

The participants are aged between 12 and 14 years old, so the average age is 13.11.

Regarding the distribution of subjects per group (*verum*, control and waiting list), each group involved 22 participants.

The *verum* group (*Qigong*) has 22 participants, 12 female (54,5%) and 10 male (45,5%). Age ranging between 12 and 14 and the average age of the group is 12,95.

The control group (placebo *Qigong*) consists of 22 participants, 11 male (50%) and 11 female (50%). Age ranging between 12 and 14 and the average of the group is 13,00.

The waiting list group involves 22 participants, 11 female participants (50%) and 11 male participants (50%). Their ages vary between 13 and 14, and the average is 13,36.

Students in the *verum* group, as well as in the control group, were instructed to perform the exercises every day during 4 weeks.

To determine whether there were statistically significant differences between the results of the three dimensions of the D_2 - Attention test at different times (pre-test, post-test and follow-up) the ANOVA was used as an instrument for repeated measures.

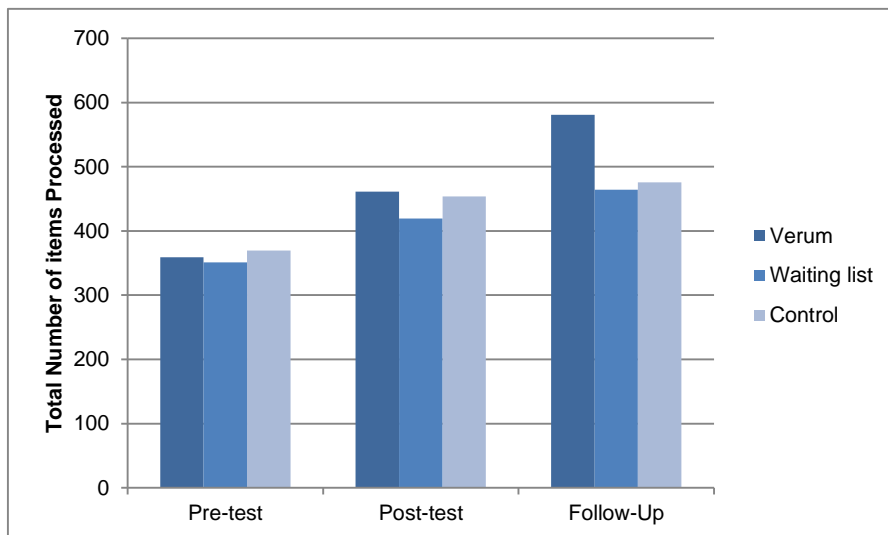
The following data that is presented are the hypotheses and obtained results of the different D_2 - Attention test.

Hypothesis 1: There are some differences between the groups (*verum*, control and waiting list) in the achieved results in the TN (Total Number of Items Processed), after four weeks.

The TN incorporated in a quantitative measurement of performance, which considers the number of characters processed in 14 lines and allows to evaluate two aspects of attention (focused/ selective and sustained) as well as the speed with which individuals process information (velocity of execution), the amount of work done (productivity) and motivation.

Graph I represents the development of the groups from the obtained results in different moments in TN:

Total Number of Items Processed (TN) processed at different moments



Graph I Evolution of the groups (*verum*, waiting list, and control) in terms of behavior through the study of TN at different times, with different techniques

The results demonstrate that in the pre-test there are no statistically significant differences in TN related with the group (*verum*, control and waiting list) $p = 0,64$.

However, there are statistically significant differences in the TN results in the different groups (*verum*, control and waiting list) $p = 0,000$.

Statistically significant differences can also be found between the *verum* group and the control group and between the *verum* and waiting list groups in the follow-up stage. Therefore, at the third moment of application of the D_2 - Attention test, the *verum* group

presents a higher TN average when compared to the control and waiting list (respectively, $p = 0,000$ e $p = 0,000$).

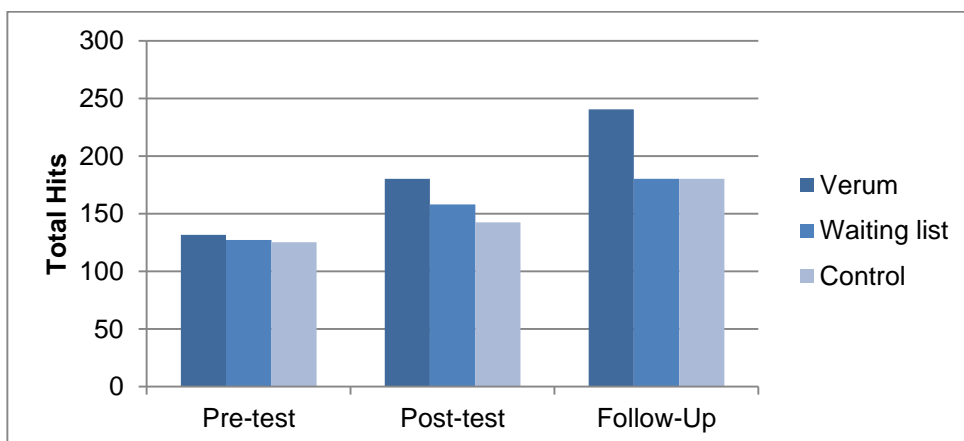
When analyzing the graph I, we acknowledge that the starting point is the same and that by the second moment all groups had progressed in terms of processing characters, but after the second moment there is a bigger development in the *verum* group and control group. The first continues to improve until the third moment and the second shows a very slight progression. The waiting list group, however, progresses more moderately during the three phases.

Hypothesis 2: There are differences between the groups (*verum*, control and waiting list) in the obtained results in TH, after four weeks.

Total Hits (TH) is a quantitative measurement of performance that takes into account the number of characters marked correctly in the 14 lines. This evaluates the accuracy / effectiveness of the subject performing a task. This is an indicator of accuracy and efficiency. This indicator only exists in the Portuguese and Spanish versions of the D₂ - Attention test.

Graph II represents the development of the groups in terms of the obtained results in TH at different moments:

Total Hits (TH) processed at different moments



Graph II Development groups (*verum*, waiting list and control) in terms of behavior through the study of TH at different moments, with different techniques

The results reveal that during pre-test stage there were no statistically significant differences in the TH levels according to the group (*verum*, control e waiting list) $p = 0,59$.

When analysing the TH results, we can see that there are statistically significant differences between the distinct groups after four weeks (follow-up) – $p = 0,000$.

The results suggest statistically significant differences between the *verum* and waiting list groups in the post-test ($p = 0,003$), the *verum* group is the one that presents, on average, a higher number of right answers (TH) when compared to the waiting list group. Simultaneously, we can also spot statistically significant differences between the *verum* and control groups and the *verum* and waiting list groups ($p = 0,000$ for both). However, it is the *verum* group wich presents a higher TH average.

By analysing the graph II, we can say that by the second moment all groups progressed in terms of processing characters, but after the second moment there is a greater development of the *verum* group. At the third moment (follow-up), this group continues to positively stand out in comparison with the other groups. Although the development in the control group was much quicker at the second moment, both groups eventually converge in the follow-up.

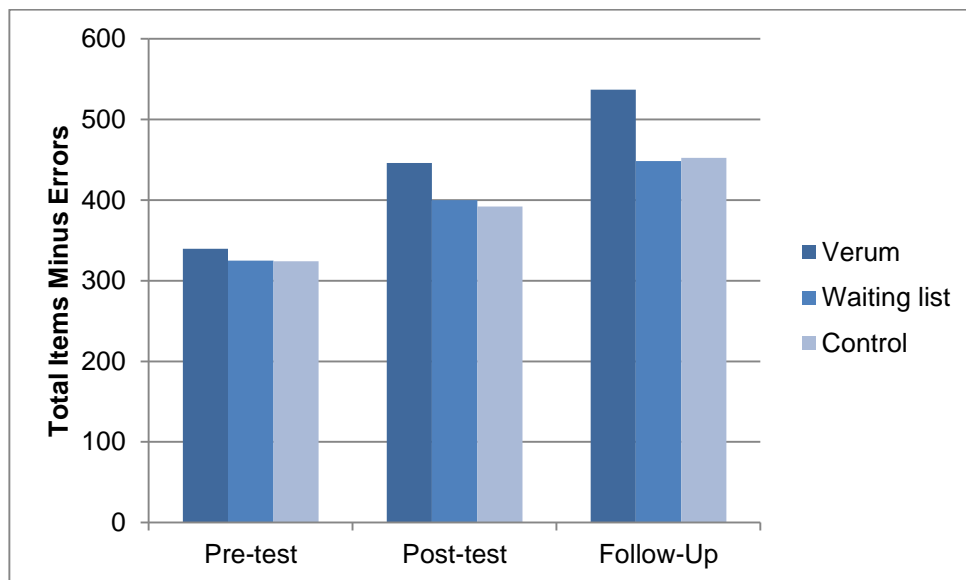
Hypothesis 3: There are differences between groups (*verum*, control and waiting list) in the results in the total number of items processed minus errors (TN-E), after four weeks.

The TN-E allows us to evaluate the control of attention and the inhibition of inappropriate behaviours, as well as the relationship between speed and meticulousness in performance.

The results reveal that during pre-test stage there were no statistically significant differences in the TN-E levels according to the group (*verum*, control e waiting list) $p = 0,60$.

Graph III represents the development of the groups in the obtained results in TN-E at different moments

Total Items Minus Errors (TN-E) processed at different moments



Graph III development of the groups (*verum*, waiting list and control) in terms of behaviour through the study of TN-E at different moments, with different techniques

The TN-E results demonstrate statistically significant differences in the three groups (*verum*, control and waiting list) $p = 0,023$.

They also reveal that, in the post-test, the control and *verum* groups present differences ($p = 0,032$), as well as the waiting list and *verum* group ($p = 0,009$). Despite this, it is the *verum* group that reveals an improvement in the TN-E, in both situations.

On the other hand, in the follow-up stage, it can also be found statistical differences between the *verum* and control groups ($p = 0,008$) and between the *verum* and waiting list groups ($p = 0,012$). In both situations, the *verum* group is the more effective one.

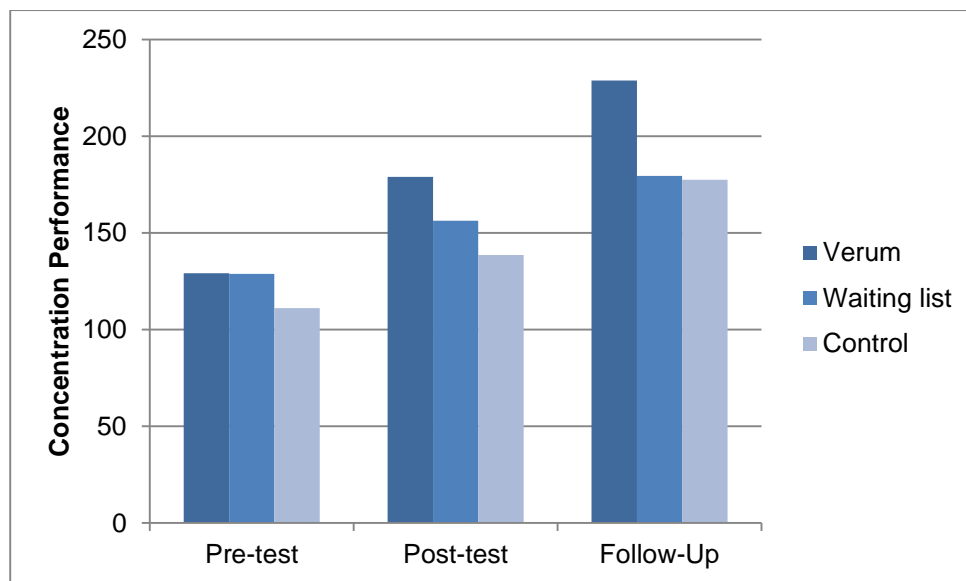
The graph III reveals a bigger distance of the *verum* group during the post-test and follow-up moments. Control and waiting list group reveal a much more moderated development and very similar between each other.

Hypothesis 4: There are differences between groups (*verum*, control and waiting list) in the obtained results in Concentration Performance (CP), after four weeks.

CP - Concentration Performance - is an indicator of the ability to concentrate. It is a measurement of the overall performance of the subject. The result, in addition, to being an excellent measurement of concentration capacity of the subject, also evaluates the combination between speed and accuracy of performance. CP, as its name states is an indicator of the ability to concentrate.

Graph IV represents the development of the obtained results in CP at different moments:

Concentration Performance (CP) at different moments



Graph IV Development of the groups (*verum*, waiting list and control) in terms of behaviour through the study of CP at different moments, with different techniques

When analysing the CP results, it can be concluded that in the pre-test, there are no statistically significant differences according to the group (*verum*, control e waiting list) $p = 0,11$.

The data unveils differences of statistical relevance between CP results in the different groups (*verum*, control and waiting list), with a $p = 0,004$.

In the post-test, the *verum* and the waiting list groups register statistically significant differences ($p=0.002$), being the *verum* group the ones that presents a higher concentration index.

On the other hand, when considering the follow-up stage, there are statistical differences between the *verum* group and the control group ($p=0.001$) and between the *verum* and waiting list groups ($p=0.001$). In both situations, the *verum* group registers a higher concentration performance.

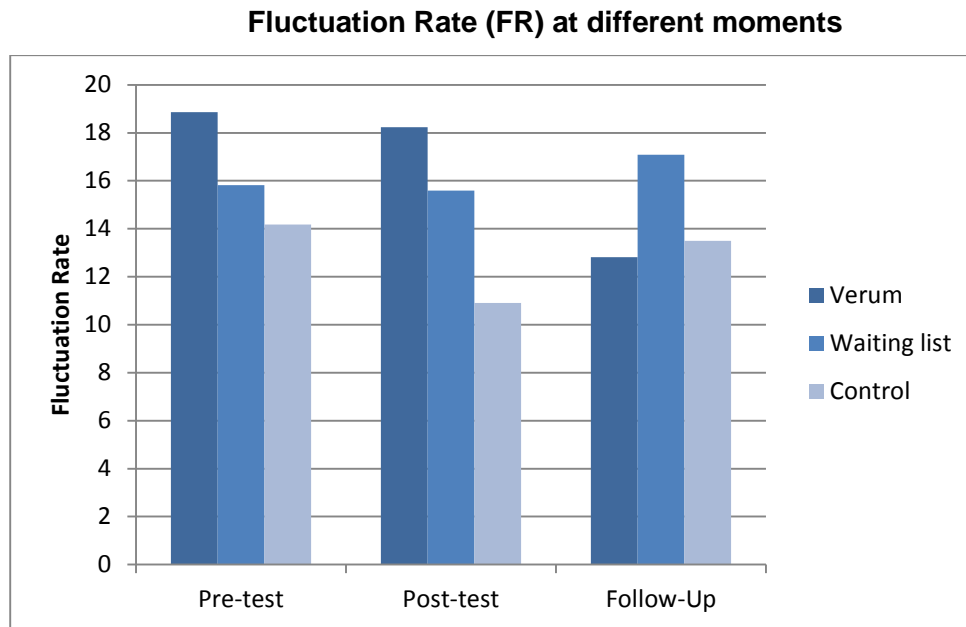
By analysing the graph IV we can conclude that up to the second moment all the groups develop in terms CP.

However, by the second moment the progression of the *verum* group is well highlighted. By the third moment, the *verum* group continues to stand out positively in comparison to the other groups. Although the progression of the control group is quicker in the second moment, this eventually converges in the follow-up with the waiting list group.

Hypothesis 5: There are differences between groups (*verum*, control and waiting list) in the obtained results in Fluctuation Rate, after four weeks.

FR - Fluctuation Rate refers to the difference between the maximum and minimum number of characters processed. This parameter evaluates the stability and the consistency performance of the subject during the 14 lines (in other words, the temporal persistence).

Graph V represents the development of the groups in the obtained results in FR at different moments:



Graph V Development of the groups (*verum*, waiting list and control) in terms of behaviour by studying the FR at different moments, with different techniques

The Fluctuation Rate (FR) in the pre-test shows results have no difference in function of the group (*verum*, control e waiting list) $p = 0,11$.

There are, however, statistically significant disparities in the FR results between the three distinct groups ($p = 0,003$).

We can also find statistically significant differences when analysing the post-test results between the control and waiting list groups ($p = 0,011$), as the control group presents a higher fluctuation rate. On the other hand, there are differences between the *verum* and waiting list groups as well, considering that the *verum* group has a lower fluctuation rate ($p = 0,000$).

Apart from all the dimensions described above, it is also important to give importance to the stability and consistency of the subjects' performance on the task to be able to infer about the attention span.

Through the analysis of the graph V we can infer that the *verum* group gradually reduces the difference between the maximum number and minimum number of characters processed over the 14 lines that make up the test. The submission of the test in the follow-up moment coincided with the phase of evaluation forms, i.e. a phase of greater exposure to *stress* and anxiety by the students. At this time the control and waiting list groups, unlike the *verum* group, failed to maintain consistency in paying attention. This follows what was mentioned in the review and what was mentioned in the literature above by authors such as Bercovitz-Braunstein (2003), Skoglund & Jansson (2007), Saganha *et al.* (2012) who consider that the exercise of *Qigong* may reduce stress.

7. Discussion

The data collecting was always performed after the second weekly class of physical education for the three groups: *verum* group, control group and group waiting list.

In the pre-study we focus on measurability of effects and sample selection. Then, we proceeded to apply a pre-test to make sure that there were no statistically significant differences among the three groups, in the 5 parameters assessed by D_2 : TN - $p = 0,64$, TH - $p = 0,59$, TN-E - $p = 0,60$, CP - $p = 0,11$, FR - $p = 0,11$.

The selected sample incorporated into three groups with similar characteristics both in terms of gender and in terms of age. Consequently, the *verum* group consists in 10 boys and 12 girls with an average of 12.95 and the control group consists in 11 boys and 11 girls who are 13 years old. The waiting list group includes 11 boys and 11 girls and has an average of 13.36.

Regarding the results obtained in the D_2 - Attention test, we can conclude that the *verum* group provides the best results in terms of the two sides that this dimension evaluates (focused and sustained attention), as well as the speed with which the participants process information, the amount of information processed and motivation with which the task is performed, in comparison to the other two groups.

Therefore, taking into account that attention is a multidimensional process which comprehends the Total Number of Items Processed (TN) as one of its multiple dimensions, we can say that, as time elapses, the *verum* group benefits greatly from the *Qigong* intervention technique in terms of the attentional process (participants become faster in completing the task, revealing more productivity).

Regarding the Total Hits (TH) the *verum* group received positively the benefits from the *Qigong* intervention by presenting superior results compared to the other two groups. So, with the continued practice of *Qigong*, it is found that the accuracy and efficiency with which the subjects perform their tasks is superior. Since the accuracy and efficiency are essential conditions to assess the attention levels of the subjects, it can be

concluded that, the subjects that benefit from this technique significantly increase their levels of attention.

If we consider the development of the three groups in terms of their effectiveness in performing the task (D_2 - Attention test), we found that participants who constitute the *verum* group presented most positive results, when compared to the other groups. This condition means that the intervention made with this group – the *Qigong* technique - can positively affect participants' ability to control the focus of attention and inhibit inappropriate behavior, increasing the speed of the task performance with a higher level of meticulousness, in other words, with fewer errors in performing the task.

Although it appears that over time all groups positively increased their concentration performance (CP), the *verum* group continues to be the one that stands out, with, on average, more significant results compared with the other groups. Thus, it is at the post-test and follow-up evaluation moments that these participants stand out from the others, showing a significant increase in their ability to concentrate on the task, coupled with the improvement in the speed and accuracy of their performance. This dimension being an indicator of the concentration ability of the subject, it can be said that the *Qigong* technique helps to increase the concentration of the subjects for the task. This analysis supports the literature of Jouper & Hassmén (2008), who consider that individuals who regularly practice *Qigong* are more motivated, less stressed and more focused during exercise than those who do not adhere to a regular regimen.

If we look in particular at the follow-up moment it is found that the fluctuation rate of the subjects in the *verum* group significantly decreased in comparison to the other groups.

Since this group is the one benefitting from the *Qigong* intervention, and since this condition is what distinguishes this group from the others, we can say that this intervention positively helps the participants in terms of persistence of the test in time, i.e., when applying D_2 - Attention test at different moments, the *verum* group participants progressively decrease the difference between the maximum and the minimum number of letters processed along the 14 lines which make up the test.

8. Conclusion

The results are consistent with the hypothesis that *Qigong* can positively influence levels of attention. According to our data, *Qigong* has increased the attention levels of these students.

In future it would be advisable to conduct further studies and examine a broader sample and for a longer period of time, in order to maximize the statistical power of the data and respective validation.

We concluded that all the goals were achieved, although it would be preferable to have a broader sample, the results are consistent with the hypothesis that *Qigong* can influence in a positive way the various levels of attention. According to our data, *Qigong* accelerated the attention in these students.

Taken under consideration all of these dimensions of D_2 - Attention test and the fact that it allows evaluating the attention of its participants, it is verified that in the *verum* group (intervention *Qigong* subject group) it is most evident the bigger (positive) impact of results in the different dimensions.

Thus, the technique of *Qigong* helps participants to improve their skills of paying attention and of obtaining best results in tasks that require the use of this ability.

Just as Witt *et al.*, (2005), we believe it is feasible to integrate *Qigong* in classes, due to the time spent / benefits obtained in terms of the focus paying attention, which is essential in the teaching / learning process.

As Jouper & Hassmén (2008) and through the analysis of data, we found that the regular practice of *Qigong* influences students to be more motivated, less stressed and more concentrated.

This study confirms that, conventionally, the effects related with *Qigong* can be made objective by psychological values.

The D₂ - Attention test is a tool that allows evaluating objectively the effects of *Qigong* on students' attention. In fact, as Brickenkamp & Zilmer (2007) argue, this test provides accurate information about multiple dimensions of attention. Our study analyses the objective parameters that can be used in other studies on the effect of *Qigong*.

The obtained results in D₂ - Attention test indicate that the exercise *White Ball* increments the attention of the adolescents, in school environment, in a significant way.

9. Final considerations

The results are consistent with the hypothesis that *Qigong* can positively influence levels of attention. According to our data, *Qigong* has increased the attention levels of these adolescents.

Qigong is a good alternative to pharmacological treatment because it improves students' attention in school. This is also a very accessible alternative as well as easy to practice.

In future, it would be useful to conduct other studies in this area and to examine a more widened and long term sample in a longitudinal research, in order to strengthen the statistical power of data and its subsequent validation.

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11. Annexs

Annex 1 – Data sheet D₂

Nome: _____ Idade: _____ Sexo: F M

Habilitações Literárias: _____ Profissão: _____ Data: ___/___/___

d2

TESTE DE ATENÇÃO
R. Brickenkamp

Este teste avalia a sua capacidade de atenção numa determinada tarefa. Nesta página encontrará um *Exemplo* e um *Item para Treino*.

EXEMPLO

Repare no exemplo. O exemplo é constituído por três letras **d**, cada uma delas acompanhada por dois traços. O **primeiro d** tem dois traços em cima, o **segundo d** tem dois traços em baixo e o **último d** tem um traço em cima e outro em baixo. Repare, todos os **d** têm dois traços.

A sua tarefa consiste em procurar as letras **d** iguais às do exemplo, ou seja, com dois traços e assinalá-las com um traço (**/**). Caso se engane, faça uma cruz (**X**) sobre a letra que assinalou incorrectamente. Atenção, existem letras **d** com mais de dois traços e com menos de dois traços, assim como letras **p** - estas letras não devem ser assinaladas.

Não se esqueça que deve assinalar, apenas, as letras **d** com dois traços. Pratique agora no *Item para Treino*.

Cada letra do *Item para Treino* encontra-se numerada. Deve ter assinalado as letras com os seguintes números:
1, 3, 5, 6, 9, 12, 13, 17, 19 e 22.

Quando voltar a folha (POR FAVOR, NÃO VIRE AINDA A FOLHA) irá encontrar 14 linhas, idênticas à linha em que esteve a praticar. A sua tarefa consiste em **assinalar todos os d com dois traços**. Irá começar na linha 1; quando eu disser MUDAR, terá de passar para a linha 2, quando eu disser novamente MUDAR terá de passar para a linha 3 e assim sucessivamente. Tenha atenção para não saltar nenhuma linha.

Trabalhe o mais rapidamente possível sem cometer erros.

POR FAVOR, AGUARDE ATÉ QUE LHE SEJA DADA A INDICAÇÃO PARA VOLTAR A FOLHA.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

ITEM PARA TREINO

Annex 2 – Statement of authorization to use D₂ Test



BEYOND KNOWLEDGE*


DECLARAÇÃO

Para os devidos efeitos, informamos que a CEGOC-TEA detém os direitos de adaptação à língua portuguesa e comercialização do *Teste d2* (teste de atenção) para território português e africano.

Informamos também que, segundo os nossos registos, o Instituto de Ciências Biomédicas Abel Salazar - ICBAS (Universidade do Porto), com o número de contribuinte 501413197, adquiriu à CEGOC-TEA a 24/01/2013, o *teste de atenção d2* com 200 avaliações. De acordo com a informação facultada no momento da aquisição, as avaliações seriam utilizadas no âmbito da tese de mestrado intitulada *The Influence of Qigong on Attention in Adolescents*, da autoria de Leonel José Marques Duarte (cartão de cidadão nº 11029167). Dado que o mestrando não tinha a qualificação académica e profissional necessária para a utilização de testes psicológicos, a CEGOC-TEA confirma que recebeu da Dr^a Patrícia Mariana Marques Mendes (Psicóloga e investigadora no ICBAS) cópia do certificado de habilitações e o formulário de qualificação profissional (onde se responsabiliza pela correta utilização do teste em questão) devidamente preenchido.

Por ser verdade e nos ter sido solicitada, vai a presente autenticada com o carimbo desta instituição.

Lisboa, 1 de Setembro de 2013


 Dr. Mário Jorge Valente Ceitil
 Managing Partner
 CEGOC-TEA

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 Sociedade por Quotas com Capital Social de 250.000 euros - Contribuinte nº 500 059 918 - Matricula C.R.C. Lisboa nº 44542

Annex 3 – Model of the consent form signed by the guardians

**CONSENTIMENTO INFORMADO, LIVRE E ESCLARECIDO PARA PARTICIPAÇÃO EM
PROJETOS DE DOCÊNCIA E/OU INVESTIGAÇÃO
de acordo com a Declaração de Helsínquia¹ e a Convenção de Oviedo²**

Por favor, leia com atenção a seguinte informação. Se achar que algo está incorreto ou que não está claro, não hesite em solicitar mais informações. Se concorda com a proposta que lhe foi feita, queira assinar este documento.

Título do estudo: The Influence of Qigong on Attention in Adolescents (A influência do *Qigong* na atenção em adolescentes).

Enquadramento: O estudo será realizado na Escola E.B. 2,3 de Arões (Agrupamento de Escolas de Fafe).

No âmbito do projeto de Mestrado de Medicina Tradicional Chinesa do Instituto de Ciências Biomédicas Abel Salazar da Universidade do Porto, orientado pelo Professor Doutor Henry Johannes Greten, Professor Doutor Jorge Machado e Mestre Mário Gonçalves.

Explicação do estudo: Com este estudo pretende-se verificar a eficácia e os efeitos do *Qigong* na atenção dos alunos, tendo como objetivo final encontrar uma alternativa válida para os problemas de atenção dos jovens em idade escolar. Serão realizadas 2 sessões semanais, durante 4 semanas, perfazendo um total de 8 sessões de *Qigong*.

Neste estudo vão participar 3 grupos da Escola E.B. 2,3 de Arões.

No início, durante e no final do estudo ambos os grupos realizarão um teste validado que mede a atenção dos estudantes.

Condições e financiamento: Este é um estudo não financiado, os participantes são voluntários e o estudo não lhes causará qualquer tipo de prejuízos ou problemas de saúde.

Confidencialidade e anonimato: Todos os dados recolhidos para o presente estudo asseguram uma total confidencialidade e anonimato dos participantes, os seus nomes nunca serão tornados públicos.

Agradecimentos e identificação do investigador : Eu, Leonel José Marques Duarte, estudante do segundo ano de Mestrado em Medicina Tradicional Chinesa do Instituto de Ciências

¹ http://portal.arsnorte.min-saude.pt/portal/page/portal/ARSNorte/Comiss%C3%A3o%20de%20C3%89tica/Ficheiros/Declaracao_Helsinquia_2008.pdf

² <http://dre.pt/pdf1sdip/2001/01/002A00/00140036.pdf>

Biomédicas Abel Salazar da Universidade do Porto, Professor de Educação Física na Escola E.B. 2,3 de Arões, agradeço toda a colaboração que possibilita a realização deste projeto de Mestrado.

Leonel José Marques Duarte, Professor de Educação Física, Escola E.B. 2,3 Arões.

Assinatura:

Eu, abaixo-assinado,

BI: _____

Representante legal de:

BI: _____

Declaro ter lido e compreendido este documento, bem como as informações que me foram fornecidas pela pessoa que acima assina e que considero suficientes. Foi-me garantida a possibilidade de, em qualquer altura, retirar o meu educando da participação neste estudo sem qualquer tipo de consequências. Desta forma, aceito que o meu educando participe neste estudo e permito a utilização dos dados que de forma voluntária forneço, confiando em que apenas serão utilizados para esta investigação e nas garantias de confidencialidade e anonimato que me são dadas pelo investigador.

Arões (S. Cristina), ____ de _____ de 2013

Assinatura do representante legal:

Assinatura do participante menor:

Assinatura do investigador:

ESTE DOCUMENTO É COMPOSTO DE 2 PÁGINAS E É FEITO EM DUPLICADO:

UMA VIA É PARA O INVESTIGADOR, OUTRA É PARA O REPRESENTANTE LEGAL DO MENOR QUE CONSENTE O ESTUDO.

Annex 4 – Opinion of the Ethics Committee ICBAS-UP



INSTITUTO DE CIÊNCIAS BIOMÉDICAS ABEL SALAZAR
UNIVERSIDADE DO PORTO

Parecer da Comissão de Ética do ICBAS-UP

PROJETO Nº 019/2012

Título: Influência do Qigong no desenvolvimento do processo de atenção e concentração em estudantes juvenis.

Investigador Principal: Leonel José Marques Duarte

Orientador: Professor Doutor Henry Greten

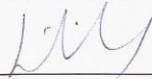
Coorientador: Professor Doutor Jorge Machado e Mário Gonçalves

Duração do Projeto: até 30 de junho de 2013

A Comissão de Ética do ICBAS-UP reuniu dia 19 de fevereiro de 2013 no edifício do ICBAS - Sala de reuniões do Departamento de Ciências do Comportamento, na presença de Liliana de Sousa, Manuel Vilanova, Margarida Araújo, Maria Antónia Gonçalves, Maria Paula Faria e Mário Paulo Faria. Decidiu emitir parecer favorável à realização do projeto supracitado, por unanimidade.

Solicitamos que envie a esta Comissão um resumo dos resultados obtidos na sequência deste projeto.

Com os melhores cumprimentos,

Pela Comissão de Ética do ICBAS-UP,


Prof. Doutora Liliana de Sousa (presidente)

To whom it may concern,

The above project is in accordance with the Portuguese law and the ICBAS-UP Ethics Committee criteria.