Exploring the aspect of psychosomatics in hypothyroidism: The WOMED model of body–mind interactions based on musculoskeletal changes, psychological stressors, and low levels of magnesium

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Summary Patients with hypothyroidism can present a series of so-called residual symptoms which are said to be without physical pathology. These symptoms, however, affect negatively the well-being state of these patients. Currently there are no explanations for this situation. Based on previous investigations done with thyroid disease patients we have carried out a clinical examination which is centered on musculoskeletal features together with a simple evaluation of psychological stressors (scaled 1–3). Laboratory diagnosis was focused on serum magnesium. This report includes the data from 166 women including 58 euthyroid controls (six males) and 108 patients with hypothyroidism (eight males).

The most common complaints seen in our patients included fatigue, being easily tired, concentration deficit, ankle instability, and gait insecurity, giving way of the ankle, muscle cramps in the shanks, visual disturbances, irritability, and vertigo sensation. Besides this symptomatology a great majority of the patients (89.5%) presented musculoskeletal alterations. The main finding was that of lateral tension which entails an eccentric muscle action of the affected lower extremity. Lateral tension was always accompanied by (forward) rotation of the hemi-pelvis of the affected side. Idiopathic moving toes were found to be independent of lateral tension. Stress scores in patients were higher in patients than in the control group. Serum magnesium levels were significantly lower in patients (0.87 ± 0.1 mmol/l vs. 0.92 ± 0.07 mmol/l, p = 0.041)

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1. Introduction

Since almost a decade we have been involved in the diagnosis and treatment of benign thyroid disease. Within this frame we have been repeatedly confronted with a — now — standard situation where patients that are being treated either for hypo- or hyperthyroidism and who have unremarkable laboratory results still present residual complaints that do not respond to thyroid treatment. Such patients are considered by experts in thyroid disease to be actually suffering from psychosomatic illness (Weetman, 2006). These patients place a dilemma since practitioners consider that these symptoms have no physical pathology (Burton, 2003). One possible approach could be to handle the topic as being medical unexplained symptoms (MUS) and consider them to “refer to bodily symptoms that do not have a physical health explanation” (Gask et al., 2011). By this, patients are left alone.

Ott et al. (2011) have enumerated such residual symptoms seen in patients with Hashimoto’s thyroiditis including chronic fatigue, dry hair, chronic irritability, chronic nervousness, a history of breast cancer and early miscarriage, and lower quality-of-life levels. In a similar fashion Samuels et al. (2007) described psychological symptoms and/or cognitive dysfunction in patients being treated with thyroid hormone. Jonklaas and Burman (2013) described that treated patients with hypothyroidism present less psychological well-being and more fatigue. In a more general way, one can find several publications dealing with stress or stressful events, panic disorders in thyroid disease (Marañón, 1921; Lidz and Whitehorn, 1950; Mandelbrote and Wittkower, 1955; Gray and Hoffenberg, 1985; Winsa et al., 1991; Harris et al., 1992; Harsch et al., 1992; Sonino et al., 1993; Kung, 1995; Radosavljevic et al., 1996; Matsubayashi et al., 1996).

These reports — and others in the literature — point toward a dual problem in clinical practice, i.e. how to deal and explain the remaining symptoms in these patients and how to treat them? This apparently unexplainable situation has motivated us to search for an explanation as well as for a treatment for such patients.

2. Patients and methods

2.1. The environment

We carry out our clinical work at a private institution (WOMED, Innsbruck, Austria, http://womed.at). Our primary work is in the field of endocrinology covering reproductive medicine including in vitro fertilization (IVM) and thyroid diseases (RM). Through time we have developed an integrative approach in our practice that is based on the following techniques: Applied Kinesiology (Walther, 2000), TCM, Western herbs, sports medicine, and manual medicine. Besides this, body—mind techniques such as Reiki and Shuar shamanism, are available. This combination is what we call the WOMED model.

2.2. Patients

This report includes the data from 166 women including 58 euthyroid controls (six males) and 108 patients with hypothyroidism (eight males). Every patient is examined following our previously described strategy that is aimed at identifying alterations of the musculoskeletal system. The main alterations that can be found include lateral tension, idiopathic moving toes (IMT), and leg length discrepancies associated with rotation of the hemi-pelvis (Moncayo and Moncayo, 2007). A follow-up examination was done 3–6 months after the patients received a supplementation regime consisting of a magistral prescription of pure magnesium citrate t.i.d. containing 1.4 mmol elemental magnesium per capsule.

All procedures were done in accordance with the Declaration of Helsinki (World Medical Association, 2000).

2.3. Simple stress score

Based on the description made by Parry on the association of stress and fright with thyroid disease (Parry, 1825) we evaluated the presence of psychological stressors. The specific
questions related to stressors included: (1) History of a traumatic situation, e.g. psychological or physical trauma as a child or care deprivation as a child. (2) Current stressful situations at home or at work or in connection with education challenges (e.g. term examinations at a university). (3) General feeling of anxiety and/or feeling of fear, panic attacks. These items are a simplified reduction of the items originally described by Rahe et al. (1964) who used the Schedule of Recent Experience. A quantification of the magnitude of such events as presented by Holmes and Rahe (1967) was not pursued by us. In our study the maximal score was 3. For subjects having a score of 2 or 3, a relaxation or stress reduction treatment was done as described by us before (Moncayo et al., 2006). The subjective symptoms of the patients were recorded individually.

2.4. Laboratory parameters

Laboratory parameters investigated included thyroid functions tests as well as serum magnesium levels. Magnesium supplementation was indicated when the laboratory result was <0.9 mmol/l. This lower level of magnesium is derived from our own data based on healthy subjects with normal thyroid function.

2.5. Statistics

IBM SPSS Statistics 21 was used to analyze the data.

3. Results

3.1. Symptoms, musculoskeletal findings, and stress scores

The most common complaints seen in our patients included fatigue, being easily tired, concentration deficit, ankle instability, and gait insecurity, giving way of the ankle, muscle cramps in the shanks, visual disturbances, irritability, and vertigo sensation.

The clinical examination revealed lateral tension in 10.5% of the controls and 89.5% of the patients. Among the hypothyroid patients lateral tension was found to be one-sided in 85.2% of the cases and two-sided in 14.8%. Idiopathic moving toes were found only in 39 cases corresponding to 7.7% of the controls and 92.3% of the patients. Lateral tension findings were found to be associated with rotation of the hemi-pelvis of the affected side. The most common finding was that of an anteriorly rotated hemi-pelvis. Hypothyroid patients also presented a blockade of pelvic motion during respiration. The most common finding was that of inspiration blockade (Walther, 2000; Cuthbert and Rosner, 2011).

A total of 142 subjects provided data for the stress score evaluation. The number of controls and patients presenting different stress scores were: score 1: 33 vs. 9, score 2: 13 vs. 54, and score 3: 4 vs. 29, respectively. Our initial relaxation treatment procedure was expanded to include acupuncture with a neutral needling technique on acupoints located along the Triple Burner meridian (SJ3–SJ9) as well as the acupoint Stomach 15. The identification of these points in each patient was done using Applied Kinesiology techniques that related them to the known psychological stressors. Experienced body—mind practitioners can directly identify these points of accumulated trauma energetics (Oschman, 2006). By this, treatment of psychological stressors is specific for each patient.

3.2. Magnesium levels

The mean levels of magnesium were significantly higher in the control group as compared to hypothyroid patients (controls 0.92 ± 0.07 mmol/l, patients 0.87 ± 0.1 mmol/l, p = 0.041). Since the magnesium levels were below the threshold of 0.9 mmol/l, all patients received supplementation with magnesium citrate.

Significantly lower levels of magnesium were seen with increasing stress scores only in the hypothyroid group (controls: stress score 1: 0.95 ± 0.06 mmol/l, stress score 2: 0.95 ± 0.04 mmol/l; patients: stress score 1: 0.89 ± 0.11 mmol/l, stress score 2: 0.87 ± 0.10 mmol/l, stress score 3: 0.85 ± 0.11 mmol/l; p = 0.005; Fig. 1). Although the statistical analysis did not reveal significant differences in magnesium levels in relation to either lateral tension or IMT, we observed a trend toward lower magnesium levels in the hypothyroid group with increasing musculoskeletal involvement (Fig. 2).

3.3. Follow-up examination

After 3 months of supplementation with magnesium citrate the incidence of IMT dropped while that of lateral tension persisted. Persisting lateral tension was then treated by acupuncture using the acupoints described elsewhere (Moncayo and Moncayo, 2007; Moncayo et al., 2007a, 2007b) together with manual medicine procedures to correct pelvic hemic-rotation (Walther, 2000). Respiratory muscle
inhibitions required at the most two sessions of correction. In few patients emotional feelings (sadness, need to cry) appeared during the correction of the musculoskeletal alterations. A successful treatment was generally associated with sensation of warmth in the body followed by tiredness.

Clinical symptoms resolved in 90% of patients after 6 months of supplementation. The most common improvements were related to a better feeling of well-being, less fatigue, having more energy, improved capacity to concentrate, and less anxiety. One condition usually not mentioned at the initial examination was that of constipation. Following magnesium supplementation patients did not have this complaint.

The small group of patients that did not attain improvement (10%) was confronted with complex traumatic situations at early age. For this reason these patients had already had psychotherapy. Patients who stopped taking magnesium citrate, e.g. did not take the supplement during vacations or on a trip, experienced again some of the initial complaints. Side effects of magnesium intake, such as diarrhea, were not seen in any patient.

4. Discussion

In this series of patients with hypothyroidism we have been able to identify two forms of stressors, i.e. physical and psychological. Serum levels of magnesium were significantly low in hypothyroid patients and showed a trend toward lower levels in relation to higher stress scores. The combined therapeutical approach based on supplementation with magnesium citrate together with a relaxation treatment and acupuncture, as well as a manual medicine to correct the musculoskeletal changes, has been found to be successful in 90% of the cases. This success has been accompanied by resolution of the so-called psychosomatic or medical unexplained symptoms. It follows that patients with hypothyroidism present a situation that has more complexity than just decreased production of thyroid hormones. Unfortunately, this complex situation has not been recognized by other practitioners (Weetman, 2006).

In order to maintain scientific correctness in times of evidence-based medicine we must declare that no comparable method to ours, i.e. any standard, can be found in the literature.

We hypothesize that the presence of both types of stressors augments the daily need for magnesium supply. Our explanation for magnesium need in face of the musculoskeletal changes is centered on the eccentric muscle action that is associated with lateral tension (Moncayo and Moncayo, 2007). The stress-like symptoms of magnesium deficiency have been described by Seelig (1994) many years ago. Grases et al. (2006) have shown that anxiety and stress among students is related to increased magnesium loss, a situation which correlates with stress scales. An interesting observation made by these investigators was: “The noticeable increase in muscular tension linked to anxiety consumes an important amount of energy that is partially due to the ATP—ADP transformation” (Grases et al., 2006). We will return to this feature in section ‘Energetic aspects of magnesium and female reproductive functions’.

One feature that has hampered the recognition of magnesium deficiency has been the vague definition of normal magnesium levels while at the same time the problem of magnesium deficiency is increasing in modern life (Elin, 2010; Crosby et al., 2013). As we show in this study, control subjects without thyroid disease have a mean magnesium level of 0.92 mmol/L. This value is our current reference level.

4.1. Questionnaires on residual symptoms in hypothyroidism — what can be done?

We have looked for evidences regarding residual symptoms in patients with hypothyroidism and how to treat them. Unfortunately we found no therapeutic recommendations in these publications. We will shortly describe the findings of these studies.

Romijn et al. (2003) have described symptoms such as musculoskeletal complaints, vague feelings of being unwell, as well as depression in relation to the adequacy of thyroid hormone replacement therapy for hypothyroidism. An interesting remark made by the authors stated: “In clinical practice, these complaints are difficult to quantify by clinimetric methods or by biochemical testing”. Jaeschke approached this situation evaluating disease-specific and general HRQL items (Jaeschke, 1996). They describe that symptoms and substitution treatment did not fit together. Bianchi et al. (2004) have described alterations on health-related quality of life in patients with thyroid disorders based on the use health questionnaires. Their study showed that hypothyroid patients scored poorer. Samuels et al. (2007) used a whole battery of questionnaires including Short Form 36 (SF-36); Symptom Checklist 90 — Revised (SCL-90-R); Profile of Mood States (POMS); and tests of declarative memory (Paragraph Recall, Complex Figure), working
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memory (N-Back, Subject Ordered Pointing, Digit Span Backwards), and motor learning (Pursuit Rotor) (Samuels et al., 2007). The findings of the study included significant decrements in health status together with increased psychological stress in hypothyroid patients receiving treatment (Samuels et al., 2007). Watt et al. (2006) conducted an evaluation of thyroid-related quality of life items. In this review they identified both musculoskeletal symptoms as well as fatigue in a high proportion of patients with hypothyroidism (Table 2 in Watt et al., 2006). In spite of having identified possibly relevant issues, there is no mention as to how to approach and treat these patients. van de Ven et al. (2012) investigated the item of fatigue perception in euthyroid subjects using the RAND-36 and the shortened fatigue questionnaire (SFQ). Persons that had thyroid disease, either hypo- or hyperthyroidism, were found to experience more fatigue as compared to the general population. In the group of subjects with normal thyroid function 34% presented also fatigue. Even the inclusion of genetic markers in an investigation in relation to fatigue in hypothyroid patients has not provided any further insight into this symptomatology (Louwerens et al., 2012).

In our opinion the use of questionnaires or polls are simply statistical, demographic methods. The lack of basic information that can be taken from a thorough clinical examination does not fully qualify them as being a validated test for clinical purposes. By using a simplified stress evaluation score we have been able to decide when to add additional treatment measures (Moncayo et al., 2006).

4.2. Theories of resilience, salutogenesis, and somatization

Resilience has been recently used as a main research component in an investigation on psychosocial contributors to illness and disease (Ryff et al., 2012). Ryff defines resilience as: “the maintenance, recovery, or improvement in mental or physical health following challenge”. For her it is a working formulation of the term. Going back to the roots of the term Ryff et al. refer to the definition of resilience as given by Rutter in 1990 as being the positive component of an individual’s response to stress and adversity. In a similar way Antonovsky’s Salutogenesis involves the continuous set of challenges and adaptive responses (Antonovsky, 1985). While this attitude can be called “positive” our patients have real stress burdens that cannot simply be overcome by being optimistic. This type of burden was apparently present in 10% of the patients. One interesting statement brought by Lipowski states: “Somatization, a tendency to experience and communicate somatic distress in response to psychosocial stress” (Lipowski, 1988). Psychosocial stress is not only limited to psychosocial changes. Newer lines of investigation are relating early traumatic situations which can influence multisytem resiliency and even affect telomere length (Puterman and Epel, 2012). One of such early traumatic situation can be childhood maltreatment, which also affects telomeres (Tyrka et al., 2010).

In 2008 Garner and Boles presented evidence linking diminished mitochondrial function of Complex I of oxidative phosphorylation to symptoms of somatization. The concluding remarks include the following postulate: “We propose that energy depletion constitutes at least part of the inherited biological predisposition toward the development of depression with somatization predicted by Freud” (Gardner and Boles, 2008). It has to be mentioned that the items of their score system bear some similarities to the symptoms which we have found through the exploratory investigation.

We postulate the foundation of resilience as well as that of Salutogenesis is related to the physical, material, biochemical condition of magnesium levels. Our results show that in order to support the innate resources of healing the subjects need an optimal magnesium supplementation.

4.3. Bioenergetics, thermodynamics, TCM and mind—body interactions techniques

In order to follow the concepts contained in our WOMED model it is necessary to expand the scope of the discussion in order to include concepts of thermodynamics as well as of mind—body techniques. These topics are seldom brought in medical education, thus practitioners are not aware of these aspects.

The field of thermodynamics has provided some basic principles as to the way how living organisms are organized and how they function. In the writings of Schrödinger (1948) one can find the notion that the existence of living systems is within a world of energy and material fluxes. Prigogine et al. (1972a, 1972b) presented his theory of living organisms as being dissipative structures where evolution is related to increased flows of energy and at the same time of successive perturbations or bifurcations. In a modern analysis of thermodynamics one finds the notion that: “…both cell and ecosystems have common energetic traits. In both systems stress and/or aging will result in lower energy flow and lower specific entropy production” (Toussaint and Schneider, 1998). Going beyond the second law of thermodynamics Corning postulates: “…we believe that the role of energy in evolution can best be defined and understood in economic terms. By this we mean that living systems do not simply absorb and utilize available energy without cost. They must “capture” the energy required to build biomass and do work; they must invest energy in development, maintenance, reproduction and further evolution” (Corning, 2002). Thus energy production, energy flow, and potential perturbations have to be kept in mind. Wallace commenting on the 2nd law of thermodynamics states: “In a thermodynamically isolated system, complex structures decay toward randomness. However, in non-equilibrium systems, the flow of energy through the system generates and sustains structural complexity, and non-homogeneous structures embody information” (Wallace, 2010).

Besides these theoretical elements we have to consider the fact that we are daily involved in generating energy processes through muscle function. Generation of energy and regeneration of skeletal muscle are essential. Although some scientific descriptions of muscle function might appear to include a reductionist point of view, i.e. single groups of

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1 An oral presentation entitled “Modelo de Bio-Energética y el Sistema Muscular” was held in Quito, Ecuador, on October 24th, 2013.
muscles, single muscle fibers or even cell culture, one has to rather consider the total musculoskeletal system which is constantly working. Jaynes, in an unpublished manuscript, has discussed the function of muscle action and their efficiency according to the 2nd law of thermodynamics (Jaynes, 1983). The basic elements of muscle contraction and action have been described by Szent-Györgyi (Bangá and Szent-Györgyi, 1942; Szent-Györgyi, 1949, 2004) as well as by Huxley (1969). These investigations bring us to the mechanisms of muscle contraction including the definition of the function of myosin. Myosin alone, however, is not the source of energy: ATP has to be considered (McClare, 1975) and this situation brings us to the point where substrates, i.e. magnesium as magnesium-ATP, are required (Szent-Györgyi, 1949, 2004). In the process of oxidative phosphorylation the generation of ATP departs from the complex magnesium ADP. It follows that lack of magnesium could lead to a dysfunction of Complex V of the respiratory chain.

While Western medicine tends to apply reductionists views in order to describe disease assigned to an organ, integrative concepts of body function are found rarely in Western medicine. On the other hand such integrative concepts are living elements in TCM and osteopathy. In TCM, the so-called extraordinary meridians provide pathways that relate the feet to the head, i.e. the Yin qiao mai, Yang qiao mai, Yin wei mai, and Yang wei mai meridians. Other meridians integrate the mid-line of the body, i.e. the Chong mai, Dai mai, Ren mai, Du mai (Ellis et al., 1989; Matsumoto and Birch, 1986; Kirschbaum, 2000). One special concept in TCM is that of an organization within meridians based on the teachings of antique acupuncture points (Hicks et al., 2004). We have demonstrated these integrative principles in relation to manual muscle tests using surface electromyography (Moncayo and Moncayo, 2009). Osteopathy has relied on such integrative concepts since its beginnings (Still, 1899). Andrew T. Still when describing the osteopath he stated: "He sees cause in a slight anatomical deviation for the beginning of disease. Osteopathy means a knowledge of the anatomy of the head, face, neck, thorax, abdomen, pelvis, and limbs, and a knowledge why health prevails in all cases of perfect normality of all parts of the body" (Still, 1902). Equivalent or similar concepts of regulation can be found in the description by Luigi Stecco on fascial manipulation for musculoskeletal pain published in 1988 (Stecco, 2004). Modern textbooks of osteopathy describe these integrative concepts in the form of chains (lateral chain, central chain, etc.) (Paoletti, 2001). We propose that coordinated muscle action can be considered to be an equivalent of Yin-Yang balance between agonist and antagonist muscle groups. This description can be taken as an explanation of Qi as the innate energy being generated by muscles within the biochemical frame of magnesium-ATP. The De-Qi feeling is the propagation of muscle action following similar to the undulation waves described by Chen (Chen et al., 2011a, 2011b, 2012). Conservation of this propagation effect requires integrity of the system. Integrity means health.

What happens in a traumatic situation? Altogether, trauma can alter the basic function of muscle. In the words of Mcmakin and Oschman (2012): "Residual local tensions and gluing in the fascial network can give rise to compensating tensions extending throughout the musculoskeletal system. Such compensations can disturb more distant structures, leading to compromised movement patterns that leave the body vulnerable to further injury". This fits well into our description of the model of lateral tension (Moncayo and Moncayo, 2007). A more general view of body energetics is that of the Biofield (Rein, 2004). Some important elements described here include: "the concept of bio-information which, mediated by consciousness, functions globally at the quantum level to supply coherence, phase, spin, and pattern information to regulate and heal all physiologic processes. This model is used to explain a wide variety of anomalies reported in the scientific literature, which cannot be explained by traditional biophysics and bio-electromagnetics".

While basic medical sciences limit themselves to specific processes of single organ systems, Tataryn has presented a connecting model where: "...the mind–body paradigm extends the body paradigm to include factors such as stress, psychologic coping styles, and social supports as primary determinants of health and disease. The body-energy paradigm assumes health and disease are functions of the flow and balances of life energies (Tataryn, 2002). These elements allow us to understand and to follow pleas toward an integration into "complex disease"..." (Knox, 2010). In a review on holistic medicine, Ventegodt has described the integrative characteristics of the ancient medical systems from India, China, and Greece. The authors stress the point that treatment of traumatic events should not be limited to the present time. Old traumas have to be considered too. If they are not approached they — and their organic-psychical stigma — will remain (Ventegodt et al., 2007). Functional neuroimaging gives interesting information about CNS substrates involved in mental processes that relate past experiences to present and future ones (Szpunar et al., 2007). These cortical areas show relation to both memory processes as well as to those related to motor imagery of bodily movements, i.e. the musculoskeletal system. Szpunar et al. (2007) speak from "reactivation of previously experienced visual—spatial contexts". In our current approach for treating situations of negative recalls we work in a way similar to that used by Szpunar on contextual processing (Figure 2 in Szpunar et al., 2009) as well as that described for counterfactual thinking (Van Hoonck et al., 2013). Counterfactual thinking is activated in conflicting situations when subjects consider alternatives to past events (Epstude and Roese, 2008, 2011).

We will now discuss some selected aspects of energetic work. Growing up in Ecuador (RM) Shamenism is an ever present integral element of life. In Shuar language uwiñan means "powerful wisdom". This wisdom has been preserved in spite of attempts to undermine these indigenous practices through the Spanish conquerors. These interactions and developments in areas that were submitted to the Spanish conquista have been described by Chaumeil (1992). The shaman can visualize the past situations that have led to energy accumulation which are called tsentsaks. These capabilities fit well into the concept of mental time travel (Suddendorf and Corballis, 1997; Tulving, 2001; Blanke et al., 2005; Zentall, 2006; Arzy et al., 2008; Berntsen and Jacobsen, 2008; Botzung et al., 2008; Quoidbach et al., 2008; Arzy et al., 2009; Piolino et al., 2009; Suddendorf et al., 2009) and out-of-the-body experience (De Ridder et al., 2007). This characteristic is shared in the noetic
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4.4. Energetic aspects of magnesium and female reproductive functions

The musculoskeletal aspects which we deal with here have potential metabolic consequences since they are closely related to body energetics. The fundamental aspect in our opinion is that of ATP synthesis which requires magnesium in Complex V of oxidative phosphorylation (Ko et al., 1999; Beard, 2005). Lack of magnesium could turn oxidative phosphorylation inefficient.

In the field of Anthropology the issue of energetics has been followed closely. Jasinska and Ellison (1998) showed that physical work causes suppression of ovarian function in women due to high levels of energy expenditure. The subjects they studied had low levels of salivary progesterone. They found that the only factor having a significant direct effect on ovarian function was energy expenditure. Modern investigations have demonstrated that work-related exhaustion is related to shorter telomere length (Ahola et al., 2012). Besides these data on menstrual cycle characteristics, energetics of pregnancy and lactation is an equally important issue for energy balance and fertility (Dufour and Sauther, 2002). Suppression of activity of the reproductive axis together with decreased fertility is correlated with stress intensity. This stress can be in the form of low food energy intake as well as from increased energy expenditure in physical activity (Bullen et al., 1985; Williams et al., 2001). In later age cycle disturbances could add to psychosocial stress when fertility problems arise (Oden et al., 1999). Such changes can also be seen in the setting of in vitro fertilization (Kionoff-Cohen et al., 2001).

In an analysis of the energetic cost of walking, Kramer and Sylvester (Kramer and Sylvester, 2011) start off by mentioning the fact that energy availability is limited and that reproductive functions can suffer negative changes since: “energy used to move is lost to reproduction, an activity that is both energetically intensive for mothers”. The energetic demand is not only related to walking but also to posture. Even though bipedalism can be seen as being economical concerning locomotor energy (Pontzer et al., 2009), the effect of load-carrying, such as carrying a child, adds a further dimension into the energetic needs of women. Watson et al. (2008) showed that one sided load carrying, e.g. a mannequin on one hip (similar to carrying a child), was coupled with higher energy requirement. Other authors have also analyzed the increased energy requirement involved in infant carrying both in humans as well as in animals (Wall-Scheffler et al., 2007; Altmann and Samuels, 1992). Combining this effect of energy need for child-carrying to the axial displacement associated with lateral tension rounds up a musculoskeletal component that will influence negatively the energy balance and lead partly to “psychosomatic” changes post-partum (Bokhari et al., 1998; Groër and Vaughan, 2013).

4.5. Can our results find support from experimental data?

Some studies done under experimental conditions can be taken as indirect evidence for our findings. One key finding in our opinion is that made by Sartori et al. (2012) showing a relation between magnesium deficiency and anxiety as well as the initiation of the hormonal stress reaction beginning at the level of CRH. In a clinical and experimental review, Classen et al. (1995) have described the use of magnesium supplementation to overcome stress. Further data has shown a relation between magnesium status and emotionality (Laarakker et al., 2011) as well as enhancement of learning by magnesium (Slutsky et al., 2010) and an interaction of magnesium with N-methyl-D-aspartate receptors during brain development (Chahal et al., 1998). Mice kept under daily stressful conditions can show loss of muscle mass (Allen et al., 2010), thus showing a mind/body relationship. Finally, in relation to ovarian endocrinology, it has been shown that magnesium improves LHRH release in vitro (Adams and Nett, 1979). In conditions of magnesium deficiency, the opposite could be true altering LHRH release.

4.6. The choice of magnesium for supplementation

For oral supplementation we have chosen to use an organic form of magnesium, i.e. magnesium citrate. Using this pure magnesium preparation we have obtained satisfactory results. The daily dose has been 3 x 1.4 mmol of elemental magnesium. On-going studies with patients with thyroid disease show an increase in serum levels of magnesium (unpublished results), a feature not usually seen when non-organic magnesium preparations are given.

Several studies have been conducted with non-organic magnesium salts. In order to make them comparable to our approach we have calculated the amount of elemental magnesium contained in each preparation. In 1982 Dyckner and Wester recommended to administer 30 mmol of magnesium sulfate (!) (Dyckner and Wester, 1982). Oster and Epstein recommended up to four times 12.34 mmol using magnesium oxide (Oster and Epstein, 1988). Using
magnesium pidolate, Paolisso et al. (1992) administered 16.2 mmol of magnesium. In a study designed to treat leg cramps in pregnant women Dahle et al. (1995) administered 15 mmol of magnesium citrate magnesium/magnesium lactate. Lima et al. (1998) administered either 20.7 or 41.7 mmol of magnesium oxide to patients with diabetes (Lima et al., 1998). It is clearly evident that when using non-organic magnesium salts, the recommended daily dose is much higher than the one we have used. Experimental data have shown a better bioavailability of magnesium citrate as compared to magnesium oxide (Lindberg et al., 1990). Experimental data has shown that a combination of magnesium with selenium can influence magnesium uptake (Musik et al., 2000). We are currently exploring this option for patients with thyroid disease.

5. Conclusions

In this practical clinical study we have been able to identify stressors that show a yet unrecognized relation to the situation of well-being in patients with thyroid disease. These stressors involve alterations of the musculoskeletal system as well as psychological situations. A central finding is that of significantly decreased levels of serum magnesium. Treating these two stress components and correcting magnesium deficiency improves general well-being and ameliorates the — psychosomatic — symptom load that was initially present. We recommend the use of pure magnesium citrate, 3×1.4 mmol per day.

In a situation of magnesium deficiency or increased demand of magnesium negative consequences can arise in connection with female reproductive function. We can speculate that failure to recognize this condition in women with hypothyroidism could aggravate the post-partum period.

The adequate treatment of hypothyroid patients presenting unresolved complaints is a demanding medical task. While Western Medicine is focused on a reductionist approach, many teachings can be derived from mind—body techniques. In order to reproduce our results clinicians have to be aware of the need of expertise in endocrinology, internal medicine, gynecology, manual medicine, and acupuncture and bio-energetical mind—body aspects. This is what we call the "WOMED model".

6. Summary

What was known before in this field?

- Experts on thyroid disease have recognized that patients with hypothyroidism present residual symptoms which are not related to hormonal parameters.
- These patients have been stamped as having psychosomatic illness.
- Statistical, demographic analyses based on questionnaires dealing with quality of life parameters have further documented these residual symptoms.
- Neither clinicians nor epidemiologists have provided any therapeutic option for these residual symptoms.
- Considerable amount of debate on this topic can be found in the Internet.2

What are the contributions of this study?

- We have found that the so-called psychosomatic illness of hypothyroid patients is related to physical and psychological stressors; these conditions are treatable.
- The examination of patients with hypothyroidism is a hands-on situation in order to recognize the musculoskeletal components involved.
- A simple three-point stress score is helpful in evaluating psychological stress.
- Determination of serum magnesium levels is of central importance. Optimal levels of magnesium should be greater than 0.9 mmol/l.
- Mind—body interactions in the form of stressors are related to low magnesium levels.
- Recognition and treatment of the elements involved require either improved holistic clinical skills of the single examining physician or dedicated team work.
- We describe the intricacies of thermodynamics, noesis, Salutogenesis, resilience, bioenergetics and mind—body techniques in relation to this clinical situation.
- Low levels of magnesium can potentially have energetic consequences on Complex V of oxidative phosphorylation that can affect female reproduction.
- Persistence of a "psychosomatic" condition could aggravate the post-partum period and woman health as a whole.

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