

Environment, Biologic Rhythms, Depression and EM Radiations

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Abstract: The interaction of human beings with electromagnetic fields (EMF) artificially created can interfere in our psychobiological equilibrium. These EMF are correlated with the dissemination of radiations produced in our modern technology. For living creatures suffer under influences of these fields, once every external stimulus generates internal ones. To give evidence of the veracity that altered EM waves can be the hazardous to health. The research adapted was a literary revision about the existence of the interferences caused by low intensity radiations, especially extremely low frequencies (ELF) originated to EMF non-ionized. When reviewing known data literature that includes the intersection among these descriptors researched in technical books, sites of search and neurosciences sites such PubMedic, Medline and Lilacs. A great number of studies have emphasized that altered electromagnetic waves might cause disturbances or diseases, being CNS included. For such can interfere on the circadian cycle and therefore with our conscience quality level, due to alterations on the melatonin/serotonin circuit. It is observed an individual sensitivity to the electromagnetic radiations (EMR) and it is established to what degree EMF and/or its radiations might cause unbalances in the human organism due to the type, potentiality and period of time under such kind of exposure. It demonstrates the viability that altered electromagnetic waves could induce disturbances to biological and circadian rhythms. We already know that it is deregulation of the central biological clock, via the suprachiasmatic nucleus (NSQ) which places in the CNS is a quite simple effect seen in depressed patients, especially in MDD, BD and in seasonal depressions.

Key words: BD (bipolar disorder), circadian cycle, circadian rhythms, CNS (central nervous system), ELF, EM, EMF, EMR, MDD (major depressive disorder), NSQ

INTRODUCTION

Today we are exposed to a great variety of radiations if compared to society of a hundred years ago and we have not how to free. In the whole planet there exists, beyond atmospheric contamination, a large diffusion of radiations artificially created which produce the so called electronic pollution or ‘invisible smog’, created by waves and energy fields of our modern technology. For instance, the radiofrequencies and microwaves utilized in telecommunications, radar detection systems or electromagnetic radiations produced by electricity passage through cable nets and filaments, as created by different home appliances.

As a main condition to understand some dangerous occasional effects due to electromagnetic radiations it is necessary to complement it with two general assumptions. First take into consideration the dynamic functioning of the earth biosphere as a large integral ecosystem. Such representation remits to Gaia hypothesis, theory created in the sixties by the English scientist James Lovelock where he defends the idea of the Earth functioning like an

immense live organism able of automatic self-regulation in order to guarantee the living conditions of the planet (Capra, 2002). This brings us to suppose that its homeostasis passes through the dynamic and continuous equilibrium of electromagnetic waves and pulses which occur on the planet. There were necessary thousands of years of adaptation of all the different kinds of life in our planet to this electromagnetic and atomic environment. Truly we are biologically adapted to an electric-magnetic-chemical-radioactive mean from which we can not get rid of (Souza, 2002).

The basic principle of this work is based upon the idea that the live systems of the earthly biosphere have been suffering interventions due to the incidence of EM waves and its electromagnetic fields. A complement to the context of this idea is essential to the second general presupposition: the adoption of the systemic conception to understand such phenomenon (Capra, 1996). Since Nature (Cosmos and Earth) are interconnected and in a continuous interaction, i.e., one system influences the other by means of a chain reaction in a connection net. The systematic view was introduced in the twentieth

century by biologists of the organic school, who conceived the living organism as integrated totalities, functioning in a constant interaction under the shape of a *network pattern*, where they interact with the environment through a continuous interchange of material and energy (Capra, 2002).

In this article we will describe the interferences caused by the low intensity radiations, especially the ELF areas derived from non-ionized EMF. If the consequences are still conjectures to medical knowledge in general, the causes are not reversible such is the present civilization dependence to electric processes. Even though there are plausible evidences about this, rules and preventive measures should be taken, for when an activity raises the possibility of harm to human health and environment even if any cause and effect relation is not complete or scientifically established. And to clarify the veracity of such occurrences it is essential for the environment health as for the public health. Therefore, the real clarification implies in optimum establishment of the levels recommended to the exposition of the living being creatures to the electromagnetic fields.

ON THE RESONANCE PHENOMENON

The way which the electromagnetic fields influence us result of a well known physics phenomenon: the energy fields' interaction. It is known that in the bioelectricity universe complex the artificial EMF invades the natural magnetic fields, by way of resonance phenomenon, forcing adaptations of the human biorhythms. With regard to the physical phenomenon of the resonance, we can understand it in a simplified way as the property of transmission of energy waves be it original of sources: electric, sonorous, electromagnetic, atomic or cosmic, to a reciprocal middle. This effect generates a great increase in the oscillation amplitude through direct contact with the system in study or for induction of the correspondent frequency at the distance.

Everything in the human organism and of all living creatures functions by electric currents. As the brain commands the operation of the organs and the corporeal movements through electric impulses that pass through the nerves, we have these playing the role of cables and electric wires. So, like cables and wires, the passage of an electric current creates around itself an electromagnetic field. The electric or bioelectric human body activity is demonstrated by the cardiograph which measures the electric heart activity and the electroencephalogram (EEG) the brain one.

One of the first scientists to suspect that our planet and the ionosphere could be in the same frequency resonance with the brain waves was the German physicist W.O. Schumann. In 1954, together with Koning they succeeded in measuring the resonance proprieties of the earth electromagnetic cavity.

In fact there exists a tension gradient between the ionosphere and the terrestrial surface. This electrostatic field is not constant, but variable, and its vertical oscillation contains a fundamental frequency of waves modulated by a great number of harmonics that together constitute a pattern. The harmonic waves get to the megahertz band and have a regulatory and a stabilizing influence one the physiologic processes. These harmonic waves receive the name of Schumann waves and result of different interactions between world and cosmic electromagnetic radiations, which form the natural environment. As many biological circuits utilize the Schumann waves as a reference pattern of its activity, it will be easy to understand the biological destabilization that we suffer in the large urban nucleus (Bueno, 1992).

This phenomenon is known as Schumann Resonance (SR) with a predominant signal of 8 Hertz band (Hz). It refers to a weak, almost static electromagnetic field, which maintains the earth electromagnetic fields rhythm. The Schumann frequencies modulations are global signals which irradiate from tropical tempests. They spread around the world in this space created between Earth and atmosphere. The intensity and spectrum of Schumann Resonance change day after day according to solar activity. Such signals have a similar frequency to the electroencephalogram (EEG) demonstrated by the fact that the human brain perceives, uses and reacts to low frequency signals-Schumann Resonances, Koning (1974). At night both EEG and SR spectrum furnish a preponderance of very low frequency signals. There is a biologic plausibility between the EEG interaction and the SR signals (Beck, 1978). This plausibility is reinforced by observing that the cerebrum contains and utilizes a fixed interconnected circuit to find and react to the perceived signals.

With the technological evolution and constant electricity use by living beings they started to be submitted to a variety of electromagnetic radiation sources created by man. Living beings suffer such influences since each external stimulus generate internal reactions. Therefore it is important to understand that our senses act as a sensory body. All external informations are captured and sent to the cerebrum by means of nervous impulses, then being possible to suffer changes of their normal rhythms through external waves interferences originated from electromagnetic fields of radio -frequency and micro-waves (Scudeler, 2005). When an electromagnetic wave meets a biologic material the EMF stimulates a kinetic energy growth of biologic molecule, which might induces the ions misplace of settled positions, oscillations of molecule connections as well as rotation and orientation of bipolar molecules like water. The temperature increase may be diffuse or limited to a specific anatomic site. Consequently cellular tissues like muscles and skin absorb relatively a larger energy

quantity than an adipous tissue or osseous of low water contents (Scudeler, 2005).

According to the physical principle of susceptible absorption to the resonance circuits is demonstrated the reason way external and internal signals which conciliate the same spectrum change resonant energy into a lower level of the thermic limit. The biologic effects caused by same exposure may be classified as thermic and non-thermic. The thermic effects are due to the high temperature in the tissues or short term effects. While the non-thermic effects result of direct reactions with the biologic substance, without any significant heat transfer, they represent long term effects (Polk and Postow, 1996).

Many groups of scientists believe in the existence of significant biologic thermic and non-thermic effects, induced by non-ionized EMF of low intensity. Researchers of the bioelectromagnetism study field are convinced that interactions with artificial EMF induce correspondent biologic effects (Tenforde and Kaune, 1987).

The electromagnetic radiation is a form of invisible pollution and there is no assurance up to this point, that the limits of the existing international rules are totally safe. Now, in the non-ionized radiations field, which are probably the most common in our environment is the UHF due to the movable telephonic and the most remote present devices. It is evident that in the case of cell system it is recognized that exposure to non-thermic or low thermic intensity can be detected in living tissues and it results in well defined biologic effects like the changing in the cell membrane function, change in the metabolism and intercellular communication, DNA rupture, increased production of free radicals, premature aging, cell exhaustions, change in cerebral functions, sleep disorder, reduction of the melatonin secretion, among others (Scudeler, 2005). The author Scudeler (2005) warns that installations of Radio Base Station (RBS) should be at least 150 m far from where people live and other public agglomerations.

Under the above mentioned criteria we may consider that the electromagnetic fields interfere in our psychobiologic system, destabilizing the self-regulation processes of the human body being able to provoke upsets and illnesses (Sack *et al.*, 1987). On the other hand, due to Schumann Resonances strange causes of human activity may modify environmental condition forcing changes and adaptations anyway.

EVIDENCES OF EMF HARMFUL EFFECTS AND ITS RADIATIONS ON HEALTH

The electromagnetic contamination, especially derived from electronic pollution, is the less evident and most subtle of the radiations that we see exposed today. All electric appliances are surrounded by radiation

inclusively when they are disconnected. Even appliances located in contiguous rooms emit radiations for they traverse the walls. When we apply a variable magnetic field on the surface of a living organism, we induct oscillating electric fields into it.

Until the fifties the EMF effects were little known especially with regard to the ELF type frequency on living creatures. After 1960 the first Russian studies appeared which demonstrated biological alterations suffered by workers exposed to a high tension net like general discomfort, head-ache, stress, insomnia and even misbehavior (Bueno, 1992). In 1979 the epidemiologist Nancy Wertheimer, in collaboration with the physicist Ed Leeper, carried out epidemiologic studies with Denver (USA) citizens who lived close to high tension cables of electric transmission and concluded an incidence of a twice higher level of children cancer than the general population. This work is considered as the first one to establish a correlation between EMF and certain pathologies (Bueno, 1992).

On the other hand the author Bueno (1992) points out that: People who live close to a high tension cable suffer an overproduction of endorphins, substances produced by the organism in the natural way. The concentration of these substances, authentic drugs with a similar action to morphine, become lesser when the electric tension diminishes or when the people move away from the cables which makes them suffer a typical scene of drug addicts abstinence, deprived of their usual dosages (Bueno, 1992).

Other studies clarify that whatever source of electromagnetic fields be, their radiation may intervene with melatonin functions, a hormone preferably discharged at night through the pineal gland considered the primary neurohormone of the circadian rhythm along with the serotonin neurotransmitter. The melatonin (N-acetyl-melotonin) is an indolamine synthesized by pineal gland from the amino acid tryptophan which originates the serotonin through metabolic processes (Sousa Neto and Araújo, 2004). This hormone cycle establishes the daily and natural body rhythms and its disorderliness may provoke fatigue and depression (Farzer *et al.*, 1986). For melatonin stimulates the immunologic system and also regulates certain endocrine processes by modulating some organ functions of this circuit like: gonads, pituitary, thymus and hypothalamus (Brown, 1989a). According to the chronobiologist work by Markus *et al.* (2003): The pineal gland is able to captivate the amino acid 5-hydroxytryptophan and transform it into serotonin (5-hydroxitriptamine). The serotonin concentration level is high during the day. In the dark there is a synthesis of the NAT enzyme (N-acetyltransferase), which metabolizes the serotonin in N-acetyl serotonin. Part of this fat-soluble product is thrown into the circulation but part is metabolized by the hidroxi-

indol-O-metil-transpherase enzyme (HIOMT) into melatonin (Markus *et al.*, 2003).

The studies of Buch *et al.* (1999) and Rapoport *et al.* (1988) correlate reduction of melatonin with increased GMA (geomagnetic activity). Buch (1977) shows a significant dose-response reduction of melatonin with increasing GMA index, because the SR signal synchronizes the ELF brain patterns in a homeostatic manner and contributes to the daily circadian rhythm synchronization. Cherry (2002) complements that the solar-geomagnetic activity (S/GMA) induces a notable intensity change in the SR signal producing alterations in melatonin's levels. He considers that the occurrence in sunspot cycles there is a higher prevalence of suicides and death by cerebrovascular accident (strokes), as a result of the accented growth of the SR signal and in concomitance the physiologic level reduction of melatonin (Cherry, 2003).

Therefore, to several researchers significant changes on the frequency pattern of Schumann waves, which is part of Earth resonance (SR), can affect the ability of our immunologic system regulation, our sleep pattern and our physic perception of time (Pereira and Guerrini, 2004).

The research of Roenneberg *et al.* (2003) confirms these data as demonstrated by the circadian rhythm study in human beings, that our organism also orientates itself by sunlight variation in order to regulate basic things like sleeping, eating, disposition. Such mechanisms are essential to the well-being (Roenneberg *et al.*, 2003).

Thanks to the existence of innumerable advanced instruments of precise measurement, it is possible today to detect harmful radiations such as: radioactivity level in our houses or some construction materials; lost of load defective installations, high tension cabs or transformers and even magnetic anomalies.

There are several scenes which appearance is related depending on individual predisposition to toxic electromagnetic radiations according to bibliographic references. For instance, the abusive use of cell phone favors the appearance of brain cancer; the appearance of leukemia and other types of cancer in people exposed to electric transmission on cables; hormonal and endocrine disorders that end by affecting innumerable metabolic processes; reduction of fertility and miscarriages; psychological equilibrium disturbances, especially manifested in behavior disorders. Other correlated situations in its co morbidity found in certain events, such as in the case of the syndrome of the sick building or chronic fatigue syndrome; geographic localizations which were subject to telluric alterations or a major incidence of sun and cosmic radiation or radioactive rains; air ionization phenomenon, when occurs a sound electric positive load or an ions positive predominance in detriment to the negative loads it propitiates an ionic disequilibrium responsible for a number of psychological

affectations such as emotional imbalance, irritability, apathy, stress, anxiety, depression and a higher level of suicide attempts (Bueno, 1992).

DISCUSSION

Everyday it is more evident that the occurrences of an infirmity have not just one cause but there are many factors involved. So a disturbance is almost always a consequence of several interactions of risk factors. And we should not adopt a segmented vision and conform ourselves with its separate studying.

A healthy equilibrium, physical and psychic ends being influenced by current factors of its environment. The predominant environmental circumstances have always influenced living beings. Such fact is demonstrated by the evolutionary tendency of their physiological processes seeking to the maintenance of their vital biological cycles. That is, the determinant force of the natural environment constantly interferes in the terrestrial homeostasis, forcing the continuous adaptation of the living creatures (Margullis and Sagan, 1998).

Nowadays we find ourselves submitted to a non specific deterioration of our vitality where infirmities turn to become a consequence of an inharmonious way of living with environmental nature. With regard to this question it is necessary to know that we are constantly submitted to electronic pollution and that we should start to suspect it may really disorganize our physiological equilibrium.

If all processes which arise in Nature happen under the influence of electromagnetic forces, such fact implies that any life form is related with the electromagnetic phenomena. Without them, life would disappear according to the shape we know today. This results that the life of all living beings is also intimately connected to the variations of these fields. Besides, the immense technological progress made it possible to modify the precarious equilibrium of our surroundings for we did not take into account that poor variations may have crucial effects upon life. Even though they refer to a quite weak magnitude, they are able through resonance, to interact with all life processes (Bueno, 1992). According to the geobiologist Bueno (1992): Any dose of radiation that surpasses the natural threshold can be prejudicial or cause biological alterations. Unfortunately, such alterations always look disguised by a series of symptoms and disturbances of difficult accuracy to the point of impeding us to establish the exact relation of cause and effect (Bueno, 1992). The usual consequence is the appearance of diseases initially light, attributed to stress, climate or other life conditions. According to his experience it takes from five to seven years of radiation exposure to be considered harmful in order to develop chronic diseases like rheumatism, asthma, arrhythmia, leukemia, etc., (Bueno, 1992).

Therefore, we should not associate the idea of EMF as direct producers of diseases. It is more convenient to consider the harmfulness of such exhibitions as precursors of illnesses. That is, risk factors to the occurrence of unbalances which alter our answering capacity to environmental aggressions. Because, it commonly compromises the self-regulation processes of organism, especially the immunologic system, as a result of the weakening our body suffers under the effects of the radiations. There is, however, an individual sensibility or over sensibility to such contaminations. In fact, there are different sensibility levels to the various radiations they are being exposed to. The radiation dose that they are exposed to can be identical but personal sensibility differs a lot. It is known that electromagnetic radiations are characterized by the wave length relative to a frequency and to an irradiated energy with two main classes: ionized radiations and non ionized radiations which include an Extremely Low Frequency (ELF).

How can the EMF affect the Central Nervous System (CNS)? It is known that the earth magnetic field is oscillating, frequently varying between 8 and 20Hz. On the other hand, our cerebrum is tuned with this terrestrial pulsation between 8 and 12Hz of the brain electromagnetic activity where it is established the so called alpha cerebrum state (Bueno, 1992). This is due to the fact that the human brain has a fixed interconnected circuit and uses it to captivate and react to perceive signals, especially SR and ELF signals. And in the proportion that many biological circuits use as reference pattern of the RS signal for its activity. And because of this event it occurs the synchronization of the daily circadian rhythm and equally to the ELF patterns in the cerebrum in a homeostatic form. So, harmful alterations in natural fields resulting of the artificial EMR invasion may affect the CNS since the brain waves have an integrated interaction with the earth electromagnetic signals.

Furthermore due to the electric resonance, a natural phenomenon produced by long distance induction is known as electromagnetic induction. Such particularity may propitiate affections in the cerebrum homeostasis due to the propensity to affections in their biophysiological processes. For, according to existing evidences, alterations in circadian pacemakers precipitates severe abnormalities in the cerebrum chemistry either due to the reduction of melatonin levels or changes in the level of other neurohormones (Tolis and Stefanis, 1983). Also such circadian alterations make possible functional disorders under the neurotransmitter circuits, like serotonin, noradrenalin, norepinephrine, etc., (Soares *et al.*, 2008).

According to the above mentioned studies, changes in time and intensity of natural radiations have an influence on living beings. That is, Sun and Moon activity

alterations, sun winds, magnetic storms and magma earth movements have been associated to psychopathologic scene and slower reactions by predisposed people. These observations conduct us to suppose that significative earth electromagnetic modifications (SR) with regard to artificial signals could similarly affect the psychic arrangement and consecutively by the cognitive behavior (Balling and Hilderbrandt, 2000). Then it is conjecturable that such cognitive changes could generate interchange affective-emotional disturbances, which provoke distortions fomented by inadequate behavior or anti-social behavior due to the possibility of such radiations to alter mind states quality (Bawin *et al.*, 1975). According to such segment we deduce that people predisposed to EM radiation hyper sensibility, originated by electromagnetic contamination of altered S/GMA (solar-geomagnetic activity) or geomagnetic faulty (Hartmann's lines), possibly end developing severe disturbances (Buch *et al.*, 1999).

According to Psychoneuroimmunology, the immunity system and CNS share many common characteristics and carry out reciprocal influence (Brown, 1989b). They represent biological systems responsible for promoting healthy body equilibrium. Due to the radiations exposure originated of natural EMF and/or artificial ones, they are the first to be affected by the changes in this electromagnetic spectrum. Such alterations will interfere directly in these biological circuits originating disorders in its physiological mechanisms which are not easily correlated to events, taking into account that aggressiveness control happens in several levels of the brain, from the hypothalamus in the cerebral trunk to the neocortex. And that the serotonin shares with the melatonin the circadian rhythm control as well as it chemically interferes in the aggressive impulses control similar to the noradrenalin (Bawin *et al.*, 1975). Then, noxious changes which happened in the terrestrial magnetism or in the current of the artificial EMF can generate serious upset in the cerebral chemistry, especially in the hypothalamus.

The electromagnetic contamination after all is harmful to natural biotic rhythms, which regulate vigil and sleep periods with the capacity of induction to severe sleeping disturbances, like paradoxical sleep or sleep privation, which may compromise subsequently conscience quality states. One of the most significative of such artificial fields, called low frequency (like ELF), is the possible interference with the brain's cycles activities, that determine the different states of conscience. It has been observed that in vigil states, conscious attention or active thought, our cerebrum produces electromagnetic waves of 25, 50, 100 and 200 Hz or superior when we are very worried about something. In exchange, when we relax it lowers to 8 or 12 Hz and when we are deep asleep can emit some 4Hz waves only. After the above

mentioned it becomes easy to understand that any person obliged to remain 8, 10, 12 or 24 h followed by a low electromagnetic waves action of 50 or 60 Hz will hardly relax or rest deeply due to what his nervous system will resent and after a short or long period his immunological system will be affected by such disequilibrium (Bueno, 1992).

So, it becomes easier to suspect that alterations, even subtle, in this electromagnetic universe can provoke psychopathological scenes in more sensitive persons. For they function like stressors agents and, due to the super provoked stimulation, they are able to produce irritation sensations without a real motive. They also induct other disturbances, as a significant increase of the degree of the subjective anxiety, which promotes growing states of stress, what can facilitate the installation of a chronic stress state. This phenomenon is known by the works of Selye like *stress reaction*, where animals were exposed to electric fields for a quite short time during one to four months (Bueno, 1992).

Considering that electromagnetic disturbances also interfere in the circadian rhythm due to the possibility of altering the vigil and sleep or even can produce hormonal disorders, it is possible that they favor the emergence of current depression scenes of the successive alteration in the neuronal metabolism. Besides, we may suppose that electromagnetic disturbances can interfere with the circadian rhythm due to the possibility of altering both the plasmatic concentrations of serotonin and the physiologic levels of the melatonin. And, like this, they propitiate the occurrence of several metabolic disorders. Therefore, it is probable that it favors the emergence of a number off different types of depression as a consequence to alterations in the neural metabolism (Kripke *et al.*, 1978). The article "Melatonin and psychiatric disorders" by Sousa Neto and Araújo (2004) mentions an extensive bibliographical revision concerning the melatonin, circadian rhythm and psychiatric disorders, especially in the schizophrenia, Major Depressive Disorder (Mdd), Bipolar Disorder (BD) and seasonal affective disorder (Sousa Neto and Araújo, 2004). In the case of MDD, the most frequent discovery is the decrease of nocturnal secretion of melatonin, which could characterize the so called Low Melatonin Syndrome (LMS) and it could serve as marker of MDD (Sousa Neto and Araújo, 2004).

The Hypothalamic-Pituitary-Adrenal (HPA) axis plays a fundamental part on answering external and internal stimulus, including the biological stressors. This endocrine axes is the main long term mediator answer of body to stress. The alterations in the function of the HPA axis are related to the psychopathologic depression state. Besides melancholic depression and major depression, a series of conditions can be associated to a prolonged hyperactivity of the HPA axis. Another group of psychopathologies is characterized by a hypo activation

of the same axis with a chronic reduction in the secretion of the Corticotrophin-Releasing Factor (CRF). Patients with atypical depression, seasonal affective disease and the chronic fatigue syndrome are included in this category (Juruena and Cleare, 2007). The melatonin receptors in the hypothalamus or in pituitary mediate the melatonin's nocturnal secretion by processes which occur in the cells of Suprachiasmatic Nucleus (SNC) in the hypothalamus. Lewy *et al.* (2006) found associations between the index of depression and the circadian period. Other authors have suggested that the seasonal effects of the mood and of the behavior (seasonality) are related to alterations of serotonergic functions in axis HPA (Partonen and Lonnqvist, 1988).

Therefore, biological rhythm alterations have an important role into physiopathology of mood disorders particularly bipolar affective disorders, where the bipolar presents a retard in melatonin secretion. Their levels are lower than the seasonal unipolar and normal controls (Bunney *et al.*, 1986).

The sun illuminating cycle represents the most powerful external circadian synchronizer being one of the environmental factors promoters of the so called seasonal affective disorder (Wehr and Rosenthal, 1989). The light-dark alternation controls the melatonin biosynthesis. The responsible gene for the production of N-acetyltransferase enzyme is transcribed starting from the activation beta adrenoceptors stimulated by noradrenalin liberated in the dark period. The second messenger (cyclical AMP) of this transducer way not only induces the transduction of gene, as well as the protein stabilization. In clear constant the melatonin production is abolished. In darkness constant this production enters a free way commanded by the biological clock oscillation located in suprachiasmatic nucleus (Markus *et al.*, 2003). Although that alternation being the environmental stimulus known as capable to activate the functioning of the circadian metabolism (Lewy *et al.*, 1985). It is also necessary to take into consideration that the pattern of the RS signal is used as basic referential for the synchronization of the circadian rhythm daily. Therefore, due to the phenomenon interaction with EMF, significant variations in that electromagnetic pattern arising out of energy absorption especially resonant fields could cause metabolic disorders.

The adjustment between the environmental surroundings and the biological clock is done road neural and the light-dark alternation is the main environmental oscillation perceived to activate the circadian metabolism functioning. There is a light perception way that does not get to the cortex but does get to the hypothalamus, being therefore completely independent of vision (Markus *et al.*, 2003). The light, when producing direct stimulus on the retina, propitiates the increase of the electric activity in the organism and synthesis of proteins, as well as the activation of genes. There is a special group

of cadenced genes by light environmental stimulus, which are able to control the biological rhythm and produce their own circadian rhythm and, as consequence, they have an influence on psychological and behavioral systems (Münch, 2006).

Nowadays, it is known the existence of circadian markers named as circadian oscillator, being the most important the suprachiasmatic nucleus located in the hypothalamus, and both promote their own homeostasis of the organism. Such markers propitiate the operation of the biological clock. So that in order to have a rhythmic endogenous circadian in a living being, it is necessary that some structure operate as a pacemaker. Pacemakers can be defined as primary oscillators, which exhibit an oscillatory pattern genetically determined, self-sustainable, endogenous, even in the absence of external temporary tracks (Markus *et al.*, 2003). On the other hand, such circadian markers are co-related to two main pacemakers which regulate some physiologic processes and called also Suprachiasmatic Nucleus (SNC) in the hypothalamus - psychomotricity; nourishment; sleeping; water ingestion control; sexual behavior; corporal temperature; hormone secretions like adrenocorticotrophic (ACTH), prolactina, melatonin, gonadotrophines and, the *circadian oscillator* - rhythmical of the cortisol, temperature and paradoxical sleep, among others (Soares *et al.*, 2008). It is due to the occurrence of these harmful disarrangements in this biological context that it is expressed the noxious compromising of the EM radiations formally.

CONCLUSION

Through the group of knowledge regarding the adopted bibliography, it was verified that modifications in the natural EMF as the artificial ones can favor the emergence of psychobiological upset and illnesses. Significant disturbances in the terrestrial electromagnetic field (SR) lead to biological alterations for they interfere directly with self-regulation processes of the human body. On the same way, the artificial EMF and its radiations propitiate similar disturbances, since its variety and its intensity is a lot superior to the ones originated in a natural way.

The electromagnetic contamination can be demonstrated by the following correlation: The toxicology teaches us that a very noxious substance in great quantities can also be noxious in small quantities, when their effect is continuous and repetitive. Through the radiology we know that prejudicial effects accumulate by time and that the noxiousness of the exposing to unnatural radiations starts from zero (Bueno, 1992). Therefore, at first it would be more appropriate to consider the artificial EMF as a precursor, that is, an unbalancing circumstance that predisposes us and it turns us vulnerable to any functional upset.

On this work we demonstrated that some scientific segments differently than that of medical knowledge recognize that there are indeed plausible evidences that electromagnetic waves can cause damages to human health. Until a wide consensus occurs, as a result of an interdisciplinary growth of scientific evidences, rules and effective measures should already be adopted. For when one activity raises the possibility of harm to human health and/or environment, preventive measures should be taken, even if some cause and effect relation has not yet been established completely and scientifically. Therefore, the immediate attitude to be taken is precaution in regard to public welfare. The main idea of precaution as guidance to environmental policy and public health appeared during the United Nations Conference on Environment and Development AGENDA 21 that took place in July 1992 in the city of Rio de Janeiro. The precaution principle is a new way of thinking about environmental protection and health protection and is based in the fact that we should not expose people and environment to damages (Scudeler FCSR 2005). There are some international organizations developing such kind of research, like the World Health Organization (WHO), the International Commission on Non-Ionizing Radiation Protection (ICNIRP), the Ramp 2001 Project, the Reflex project and the European Framework Programs for Research and Technology Development. Nowadays, many countries, including Brazil, do not permit EMF lab experiments with humans. Even though under an ethic view such an attitude might be considered to be appreciated, contemporary society is still dependent of electromagnetic contamination. The lack of knowledge or disbelief about such risks and its consequences by the health professionals turn the perception of such kind of disorder a lot more difficult.

The technological progress of the current world has put us in front of an excessive radiation exhibition in our environment which turns into compromising the environmental health and thus resulting in a variety of risks and implications to collective health. The most alarming fact is that a sound perception does not exist through our basic senses, only certain subjective sensations in more susceptible persons. Even more aggravating is the overwhelming growth of innumerable polluters and toxic agents threatening the ecologic equilibrium system, which at the end produce, as a result of this atmospheric pollution, an extraordinary growth of electromagnetic radiation on the earth atmosphere, especially ELF.

As the frequency of the ELF type and, in an equivalent way to the Schumann's waves, they are used as a basic reference for the operation of the cycles of cerebral activity. Therefore, significant modifications in that spectrum of frequencies can produce disturbances in that biological circuit and to commit the state of healthy balance of their functional processes (Nair and

Sharma, 1989). Consequently, it ends for corrupting the psychic apparel making it difficult the perception of the origin of such compromising. Once, the serotonin and the melatonin are marked, up to this point, as the most committed neurohormones for the variations of the EM radiations. Thus, for the effect of the harmfulness of EMF and its EMR it is possible to cause modifications in the biological rhythms, for they reach those most important neurohormones of circadian cycle, which are somehow responsible for the regulation of the internal metabolism. Such alterations subsequently commit the circadian pacemakers and secondarily they can provoke upset in the physiopathology of the humor, especially in the bipolar affective disorder.

According to the above mentioned arguments, the EM radiations really act as factors that might provoke disorders and infirmities, but we must take into account the individual susceptibility to such radiations and the proper functioning of the immunological system in face of such occurrences.

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