I. INTRODUCTION
Radiofrequency (RF) fields are used extensively in wireless communications (mobile phones, radio and television etc.). Yet little is known about the effects they may have on human physiology. Any potential impact on health due to these fields has to be investigated and monitored. RF fields can induce electric fields in the body that can potentially alter biological functions. Given the large number of mobile phone users worldwide (~5 billion), it is a serious issue which needs special attention. Whether these radiations cause brain dysfunction is a hot area of discussion more than a decade and it still continues (Hyland 2000, Leszczynski 2001). There have been a number of conflicting reports on relationship between brain dysfunction and the radio-frequency electromagnetic radiation (RF-EMR).

A critical evaluation of behavioural and neurophysiological studies conducted in humans on the effects of mobile phone electromagnetic fields concluded that, no evidence of subjective symptoms attributed to mobile phone radiation and it does not affect the cochlear and brainstem auditory processing. The authors also argued that, earlier report on enhanced cognitive performance under RF-EMR exposure is only due to chance due to multiple comparisons (Kwon & Hamalainen 2011). Another systematic review and meta-analysis of psychomotor effects of mobile phone electromagnetic fields concluded that, RF-EMR exposure from mobile phone does not induce cognitive and psychomotor effects. However, authors suggested that, repeated intensive and chronic RF-EMR exposure and its effects on brain in highly sensitive population such as in children should be investigated (Valentini et al 2010). In the meantime, a comprehensive review on the neurophysiological effects of mobile phone electromagnetic fields on humans by Valentini et al (2007) points that, mobile phone
RF-EMR might influence the normal physiology through changes in cortical excitability.

Effects of RF-EMR from mobile phone have been extensively studied in various animal models, but controversies remain in many of these reports. Arendash et al (2010) reported that long term high frequency RF-EMR exposure (918 MHz; 0.25 w/kg) provides cognitive protective and cognitive enhancing effects for both normal mice and transgenic mice destined to develop Alzheimer’s–like cognitive impairment. Daniels et al (2009) reported that RF-EMR exposure did not affect spatial memory and brain morphology but decreased locomotor activity, increased grooming and increased basal corticosterone levels in rats. Nitzouni et al (2011) found that, chronic exposure to mobile phone radiation (900 MHz; 90 min/day for 31 days) affected object recognition task in rats, which requires a proper functioning of entorhinal-parahippocampal regions. Also, Adult rats exposed to 900 MHz electromagnetic radiation (1 hr/day for 28 days) in an exposure tube resulted in a significant decrease of the pyramidal cell number in the hippocampus of RF-EMR exposed group (Bas et al 2009). Another recent report gives an indication towards the adverse effects of RF-EMR exposure on cognitive performances in human adolescents (Thomas et al 2010).

The mobile phone RF-EMR can have several effects on body systems such as RF-EMR thermal effect, specific effect (non-thermal), or cumulative effect (both thermal and non-thermal). The underlying biological mechanism has not been settled to explain the manifestations we see in animals and in humans after the exposure to this radiation. All these can also be attributed to stress and that current research cannot separate the symptoms from nocebo effects as there is a lack of concrete experimental
evidences. One of the most understood effect of mobile phone RF-EMR is the thermal effect. The living tissue is heated by rotations of polar molecules induced by the electromagnetic field. Most of this heating occurs on the surface of the head in humans. A change in brain function due to this increase in temperature is a subject to debate because calculation of maximum temperature rise in the head after exposing to mobile phone RF-EMR is 0.1°C (Tahvanainen et al 2007). Mobile phone radiation specific effects (otherwise called the non-thermal effects) are not very well understood. Current research in this field is inadequate to give a possible explanation for non-thermal effects. Additionally, the mode of action of these radiations on CNS still remains as a mystery.

Teenagers are the heaviest users of this wireless technology over the globe and this requires a special consideration. Hence, it is important to break out the neurophysiological and psychological effects of RF-EMR exposure in adolescent period. Keeping in mind that the biological and maturational processes are highly vulnerable, in the present study we have exposed 6-8 weeks old Wistar rats, (the developmental ages of which are comparable to that of human teenagers) to microwaves (900 MHz) from a RF-EMR emitting device and studied behavioural performances, brain morphology and brain biochemical indexes.

The current study was an attempt to answer the following questions; whether exposure to RF-EMR for a period of one month causes any behavioural deficits in rats? Specifically; do the animals become anxious? Does it affect emotional learning, spatial learning and memory? What happens to motor performances? If the behaviour is affected, what could be the reason? Could it be due to biochemical changes in the
brain; such as free radical generation and alteration in the oxidative status in the brain? Does it activate any apoptotic pathway? Or could it be due to neuronal damage (apoptosis/necrosis)? Or changes occur in the neuron itself (changes in the dendritic arborization pattern). All these have to be investigated to get a clear answer.