CHAPTER 4

SUMMARY AND CONCLUSIONS
Natural Products, have been in use since antiquity, be it for preservation and fortification of foods or health care and disease management. Recent resurgence in natural products emanate from widespread and prolonged use of synthetic chemicals in foods and pharmaceuticals and consequent adverse effects on environment and health. A group of compounds namely antioxidants gained attention late primarily due to their association with genesis of various diseases and disabilities brought out in recent time through epidemiological and experimental evidences. Naturally occurring antioxidants, therefore, received attention in this context in pursuit of identifying and exploiting them for substituting for synthetic antioxidants. Oil seeds and their co-products are repository of various phytochemicals that are bio-active including antioxidation properties. Deoiled sesame cake was identified for the present investigation, since it is an abundantly available co-product of sesame oil industry and incidentally India is the largest producer of sesame in the world (5 to 7 lakh tonnes/year). The objective of this study was two fold viz (i) chemical characterization of antioxidant in sesame cake in quantitative and qualitative terms and (ii) standardization of protocol for extraction, enrichment and scientific validation of antioxidants from sesame cake. The results obtained through this investigation and conclusion drawn there from are summarized below:

Sesame seeds, from major cultivars and the deoiled meals were characterized for their lignans by HPLC and compared with commercial deoiled cake. Deoiled meals from white, red and black seeds contained 3420, 3237 and 2038 ppm lignans. Commercial cake contained 1300-3000 ppm lignans. It could be stated from the result that more than 50%
-lignans are left in the deoiled cake. Seamol, an important compound with known bioactive properties retained in the cake. This has not been identified and exploited till now.

4.2 Kinetic studies were conducted in order to standardize protocol to extract lignans using solvents. Based on the results methanol was selected as the most efficient solvent that could extract at <80°C in 16 hours. Lignan content of crude methanol extract was 1560 ppm.

4.3 Enrichment of lignan in crude methanol extract was achieved by partial purification and enrichment factor or fold purification obtained was 18, with final purified extract, containing as high as 15% lignan as compared to 0.7% in the crude extract.

4.4 A series of experiments were conducted to evaluate the antioxidant efficacy of the extract (crude and purified) using the invitro methods such as schaal oven test, β-carotene bleaching, linoleic acid oxidation, radical scavenging (DPPH), xanthine oxidase assay (NBT & cytochrome C) Synthetic antioxidants like BHT, TBHQ, Trolox and tocopherol standards were used for comparison. The results showed that purified extract at very low concentration range (5 to 200 ppm) inhibited peroxidation (30 to 80 %) significantly higher than comparable concentration of pure compounds such as BHT, Trolox, tocopherol etc. The results obtained from stability studies using vegetable oils (Soybean, sunflower, safflower) indicated that purified extract could be used as a substitute for synthetic BHT. Radical scavenging studies showed the hydrogen donating ability and superoxide scavenging properties of the extract, which had biological significance.
Detailed studies on separation of lignans and lignan glucosides were carried out. They were isolated, identified and antioxidation kinetics were studied for each compound. Sesamol, sesamin, sesamolin, sesaminol diglucoside and sesaminol triglucoside showed antioxidant efficacy in the decreasing order, sesamol > sesamolin > sesamin > sesaminol triglucoside > sesaminol diglucoside in peroxidation model system. The radical scavenging kinetics followed the order sesamol > sesamin dimer > sesamin > sesaminol triglucoside > sesamolin > sesaminol diglucoside. No studies so far have been reported on the radical scavenging effects of these compounds.

Preliminary studies suggest that sesame extract, sesamol, sesamin and sesaminol diglucoside to have significant antioxidant properties, which has potential for chemopreventive strategies. The ability of the extract and pure compounds to induce apoptosis of tumor cells reflects possible antitumor activity of the compounds. Preliminary level studies showed pesticidal and mosquitocidal effects for sesame cake extract and isolated compounds.

Detailed investigation on the lignans and their derivatives from deoiled sesame cake, hitherto, not reported has been conducted and scientifically validated their antioxidant efficacies as extract and individual compounds vis-à-vis reference compounds and established the commercial potential of sesame lignans towards substituting synthetic antioxidants. The economics being in favor, scale up studies and commercial applications in edible oil as first step with industrial collaboration are further works to be
undertaken before commercialization. A patent has been filed for the process and application based on the present studies.