Mini Review

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Lipid peroxidation in different age and ethnic groups: A review

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It is believed that free radical variations are the main cause of ageing, development of different diseases or even death. Free radicals affect biological process in a way that cells can loss their function and decrease their resistance to stress which can be related to ageing. Here the alterations of lipid peroxidation in different age and ethnic groups are review. There are many theories to explain the association between lipid peroxidation and basic nature of aging, but there is no exact evidence to explain the biological aging. Theories of aging are multi-factorial process. One of several factors that could be cause of aging process is lipid peroxidation, but inconsistent findings of many researchers have shown that lipid peroxidation may not a main reason of aging.

Key words: Lipid peroxidation, Age, Ethnic groups.

Oxidative stress is known to be a component of molecular and cellular tissue damage mechanisms in human diseases (Pasupathi et al. 2009; Satyanarayana et al. 2008; Vaziri, 2013) and increasing age (Okoduwa et al. 2013; Das et al. 1990; Gil et al. 2006; Kumar et al. 2012; Harman, 2006).The most accepted theories of ageing are the theory of free radicals. There are an association between accumulation of highly reactive molecules (free radicals) and ageing in the body. It believed that free radical variations are the main cause of ageing, different diseases development or death (Harman, 1955). Free radicals affect biological process that cells can loss their function and decrease their resistance to stress which can be related to ageing. Oxidative damage may happen when there are no balance between different antioxidants and elevated production of free radical (named as oxidative stress) (Kokoszka et al. 2001). However, the rate of this damage elevates during aging process and the antioxidative efficiency and repair mechanism reduce (Gil et al. 2006).

Expression of different antioxidant enzymes such as superoxide dismutase, glutathione peroxidase, glutathione reductase and catalase defense animal and human cells against the free radicals in the body. Superoxide dismutase (SOD) changes superoxide anions to hydrogen peroxide and then glutathione peroxidase (or Catalase) coverts hydrogen peroxide to water (Ross et al. 2000). Studies have shown that variations of superoxide dismutase (SOD) were seen in different findings. Some of these studies showed decreased (Ozbay and Dulger, 2002) or unchanged (Ceballos-picot et al. 1992) activity of enzyme by ageing. Blood is constantly exposed to oxidation stress. Antioxidant capacity of blood is high (Lewin and Popov, 1994). Decreased antioxidant capacity of blood may cause damage to red blood cells by free radicals. Sufficient activity of enzyme Superoxide Dismutase (SOD) and Glutathione Peroxidase (GPx) prevents the blood oxidative damage (Yamagchi et al. 1992). Hemoglobin damage and stimulation of protein degradation, lipid peroxidation and hemolysis may happen when red blood cells exposed to elevated levels of free radicals in the body. Some studies showed that lipid peroxidation is elevated in some diseases

(Marjani et al. 2007a; Marjani et al. 2010; Marjani et al. 2008; Marjani, 2005a; Marjani, 2006a; Marjani et al. 2007b) and during the ageing of red blood cell (Marjani, 2006b; Marjani et al. 2007c). Esterified cholesterol is high in blood. This cholesterol changes to lipid hydroperoxides (Unstable) which can convert to lipid peroxidation (Knight et al. 1992).The ageing process is one of the important risk factor for many diseases and death after about age 28 in some developed countries (Hiramatsu et al. 1992).

Free radicals may contribute to the development of different disorders during the process of ageing. There are different findings and results about whether free radicals take part in the beginning of ageing. Many studies have indicated that antioxidants system may change in different age and ethnic groups (Marjani et al. 2007b; Rikans, 1997; Ito et al. 1999; Marjani, 2005b). There are many investigations on the relationship between oxidant/antioxidant status and the process of aging in animals and humans, but the results have been inconsistent. Some studies have shown that reduced antioxidant level or elevated lipid peroxidation is not a consequence of aging in different organs and age- associated changes are may depend on species, ethnicity, sex and tissue (Rikans and Hornbrook, 1997).The present study was designed to review alterations of lipid peroxidation (expressed as malondialdehyde [MDA]) in different age and ethnic groups.

Data from numerous studies have indicated that important causative agents of aging are free oxygen radicals. Studies on mouse or rat liver have revealed that there are an age-associated increase in mouse or rat liver lipid peroxidation (Arivazhagan et al. 2001), or unchanged mouse liver lipid peroxidation (Massie et al.1983) or decreased rat liver lipid peroxidation (Rikans et al. 1991). A study has shown that that aging was associated with a 50% increase and decrease in lipid peroxidation in livers of male and female rats, respectively (Rikans and Hornbrook, 1997). Age-associated changes in some organs are not evident in others. Study on Wistar rats reveal that lipid peroxidation may increase with age in liver and brain, but not in heart or lung (Sawada et al. 1987; Barja de Quiroga et al. 1990; Perez et al. 1991). Study on mice have shown that liver lipid peroxidation levels were increased but were unaffected by aging in males (Massie et al. 1983; Koizumi et al. 1987). The effect of aging on lipid peroxidation in mouse and rat kidney showed that lipid peroxidation levels were unchanged in mice and decreased in rats (Rikans and Hornbrook, 1997). Many studies have shown that variations of antioxidants system are age related. There are different findings about the role of free radicals and oxidant damage in different diseases.

Free radicals may play a role in organ damage associated with aging. Some studies indicated that there is higher production of free radicals in aged persons than young and middle-aged persons (Cheng et al. 2013; Das et al. 1990; Gil et al. 2006; Harman, 2006). Study of Marjani et al. (2005) showed that plasma lipid peroxidation and SOD activity change significant alterations during ageing. They have shown that lipid peroxidation and SOD activity were significantly elevated and reduced in the 41-45 age groups when compared to the other age groups (Marjani, 2006b; Marjani, 2007c). Some studies have indicated that plasma lipid peroxidation and SOD activity elevated (Lewin and Popov, 1994) while other findings revealed elevated lipid peroxidation and decreased SOD activity (Ozbay and Dulger, 2002). There are also other results that they showed no significant differences of age related alteration of SOD activity (Ceballos-picot et al. 1992).

Elevated radical oxygen species from lipid peroxidation processes and reduced antioxidant defense systems with ageing may depended on free radicals elevation in the body. Thus, there is probably an association between cellular damage and oxidative variations during aging. Oxygen radical generation by the auto-oxidation of hemoglobin can cause the red blood cell expose to oxidative stress. Cellular membranes are the main place which suffers from free radicals. Thus, alteration in lipids of membrane may play a main role in the ageing process. Decreased SOD activity with ageing was seen in some studies (Ozbay and Dulger, 2002; Marjani, 2005b). This may depended on decreased and increased antioxidant enzyme activities and free radical levels during aging, respectively. Decreased activity of SOD may also relate to denaturation of enzyme. It may occur because of elevated production of free radical which is leading to enzyme oxidation. Alterations in antioxidant enzymes (reduced) and free radicals (elevated) balance may make red blood cells susceptible to free

radical damage during ageing process. There are also many studies on the role of free radicals and oxidant damage in different diseases with various ethnic groups. Study of Marjani et al. (2007b) showed that plasma lipid peroxidation (increased) and red blood cell SOD activity (decreased) change during ageing in Turkmen and Fars ethnic groups. These alterations happen in Turkmen ethnic groups in earlier age when compared to Fars ethnic groups. Some other studies showed that erythrocyte SOD activity decreased in two ethnic groups (Ozbay and Dulger, 2002; Ito et al. 1999; Bhagwat, 1997; Inal et al. 2001). These differences may depend on the ethnic origin, diet, heavy working and life style between two ethnic groups. However, some other studies showed that ethnic factor does not play a role in lipid peroxidation variations in healthy people (Kolesnikova et al. 2014). Some of diseases such as diabetes mellitus and cancer may influence the antioxidant enzyme activities in the body (Godin et al. 1998; Salnikova and Musatova, 1990; Marklund et al. 1955). Lipid peroxidation can cause cell components modification when it reacts with amino groups of intracellular proteins, nitrogenous bases of DNA and some other molecules (Rabinovitch et al. 1996). Carbonyl and sulfhydryl modification of hemoglobin may develop with high levels of lipid peroxidation which may damage some redox-sensitive molecules (Udupi et al. 1992). Additional data is need for correlation between free radical production and age. It seems that there is more complication in oxidant/antioxidant system when studies applied on patho-physiology of animals. It is still unclear that acceleration of some oxidant processes during aging may associated with endocrine decrease (Hauck and Bartke, 2000) or effect of different endocrine hormones on activation of antioxidant enzyme-specific genes (Johnson et al. 1999), or different other factor (Otero and Sanjuan 1998).

CONCLUSION

There are many theories to explain the association between lipid peroxidation and basic nature of aging, but there is no exact evidence to explain the biological aging. Theories of aging are multi-factorial process. One of several factors that could cause aging process is lipid peroxidation, but inconsistent findings of many researchers have shown that lipid peroxidation may not be a main reason of aging.

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