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Abstract

Coronary heart diseases (CHD) is the leading cause of death in the world. CHD is caused by atherosclerotic plaque in the coronary arteries. The fresh tempeh prevent atherosclerosis because this is an excellent source of antioxidants, such as protein, beta caroten, vitamin E, B₂, Omega-3, Zn, Cu, Se, Fe, Isoflavons (Genistein, Daizein, Glisitein, and Factor 24 SOD, can significantly increase the prevention of atherosclerosis with addition of vitamin C, there are compounds in the form of antioxidant network that has a function as an agent of scavenger to free radicals caused oxidative stress, as antiatherogenic.

Key Words : Tempeh, Antioxidant, Atherosclerosis

I. Introduction

3 Coronary heart disease (CHD) is the leading cause of death in the world. CHD caused by atherosclerotic plaque in the coronary arteries This occurs due to changes in lifestyle and eating habit of the society. Changes in lifestyle and diet of people lately which tend to consume a lot of fatty foods, especially those containing saturated fatty acids. Intake of foods with high cholesterol content which continues over time resulting in increased levels of LDL cholesterol in the blood. Oxidized LDL cholesterol can cause inflammation which can then continue with the onset of atherosclerosis. Dyslipidemia is a major risk factor for the occurrence of atherosclerosis. (Kumar *et al.*, 2007; and Rahmawansa, 2009).

Dyslipidemia has an important role in the occurrence of damage to the endothelial cells. When dyslipidemia have led to changes in the permeability of chronic endothelial cells and plasma constituents causing damage to endothelial cells. Damage to the endothelial cells of both small-and large can alter the permeability properties and the ability of endothelial cells to adhere to one another by connective tissue underneath. Where to normal endothelial cells that restrict the tunica intima to form a permeable barrier to regulate the entry of plasma substances into the arterial wall. Arterial wall that would induce changes in the permeability of the endothelial cells will lead to plasma constituents, such as lipoproteins which become easy entry into the arterial wall. Endothelial cell damage is going to change the nature of the arterial lumen trombosistein allowing platelets attached to the arterial wall is damaged and inflamed resulting in connective tissue beneath the contact with platelets and other elements in circulating blood. The endothelial cell damage which causes the formation of oxygen free radicals, which are triggered by cytokines, is the basis of the pathogenesis of atherosclerosis. Endothelial function is to control inflammation and immunity (Kumar *et al.*, 2007b; Murray *et al.*, 2009).

LDL oxidation causes a charge change LDL apoB-100 that tend to form aggregates and fatty streak. Oxidized LDL can serve as a chemoattractant of inflammatory cells to the inflammatory cells migrate to the network experience subendotel, then expressing endothelial cell scavenger receptor (SR). Aggregate formation and changes in LDL charge makes native LDL receptor unknown. Through SR as CD36, SR-A and SR-B phagocytosing macrophages

oxidized LDL without down-regulation, resulting in accumulation of LDL and macrophages forming foam cells (Adibhatla *et al.*, 2010).

The fresh tempeh is an excellent source of antioxidants, such as protein, vitamin E, omega-3, vitamin B2, zinc (Zn), copper (Cu), selenium (Se), Fe, isoflavones, SOD (Agung, 2013; Winarsi, 2007; Mindell, 2008; Sunita, 2009). The fresh tempeh isoflavones may increase the activity of enzymes SOD, catalase and glutathioneperoxidase (Winarsi, 2007).

Considering that the medication of atherosclerosis patients requires a long time and requires high cost, therefore the research continues to be developed, for example by using functional food, which is more effective at lower prices, and reduce the side effects. A functional food that can be used as an antiatherogenic in the long term is a combination of the use of natural materials such as fresh tempeh. This study aims to review the potency of antioxidant from tempeh to prevent atherosclerosis.

2. Discussion

Intake of foods with high cholesterol content which continues over 3 cause atherosclerosis risk factors that increase lipid metabolism, oxidative stress and inflammation. Increased lipid metabolism resulting in elevated levels of LDL cholesterol in the blood. Vulnerable oxidized LDL cholesterol, and can cause inflammation, which induces issuance IL-6, which can then continue with the occurrence of atherosclerosis. F₂-isoprostane is an end product of lipid peroxidation, and is an early predictor of early atherosclerosis. Measurement of Total Antioxidant Capacity (TAC) is an accurate measurement of oxidative stress.

The body's antioxidant system as a protective mechanism against the body free radical attack consists of many components, such as SOD, GPx, catalase and extracellular antioxidants. One component of food shortages led to a decline in the status of the overall antioxidant status so that the protection of the body against free radicals is reduced, which means the higher the risk of atherosclerosis (Muchtadi, 2009; Widowati, 2007).

Functional food of combination fresh tempeh with carrots is a harmonious combination of excellent food, one with another synergize in increasing the activity of bioactive substances it contains, mainly equally nutritious and are a source of antioxidants, in the form of protein (the amino acid composition complete, contains sufficient amount of arginine and low methionine), Omega-3, vitamin B complex, vitamin E, niacin, Zn, Cu, Se, ergosterol, phytoestrogens, enzymes (protease, lipase, amylase, glycosidase, SOD), and the hormone thyroxine and high isoflavones contained in tempeh, as well as the form of beta carotene, pectin and vitamin C contained high enough on the carrot, which acts as antidiabetic, antioxidant and antiinflammatory (Ari Agung, 2013).

Functional food of combination fresh tempeh with carrots is a harmonious combination of food, improve the effectiveness of the absorption of nutrients and bioactive substances it contains, increases metabolism, thus increasing efficacy as antiatherosclerosis (Marsden, 2008; Farida and Amalia, 2009). One another synergize in increasing the activity of bioactive substances it contains, mainly equally nutritious and are a source of antioxidants, which act as antiinflammatory and antiatherogenic, thus providing hope in the prevention of CHD (coronary heart disease) (Winarsi, 2007; Farida and Amalia, 2009). This is because the tempeh is an excellent source of antioxidants, such as protein, vitamin E, omega-3, vitamin B2, zinc (Zn), copper (Cu), selenium (Se), Fe, isoflavones, SOD (Agung, 2002; Winarsi, 2007; Mindell, 2008; Sunita, 2009). Soybean isoflavones may increase the activity of enzymes SOD, catalase and glutathioneperoxidase (Winarsi, 2007). Carrots contain beta carotene antioxidants are very high.

Carrots also contain Se, vitamin C, and B₂ antioxidants. In general, the use of beta carotene as an antioxidant in combination with other antioxidants (Winarsi, 2007). Availability of beta carotene increased with the presence of vitamin E and other antioxidants in tempeh (Sunita, 2009). Beta carotene and isoflavones important role in inducing the body's antioxidant status (Winarsi *et al.*, 2003). Tempeh isoflavones and beta-carotene may increase the activity of catalase. Isoflavones and selenium affect enzyme activity of glutathione peroxidase (Winarsi, 2007). Diet low in beta carotene, but sufficient in all other nutrients produce signs of reduced blood Total Antioxidant Capacity (Omaye *et al.*, 1997). This is in accordance with the opinion Astawan (2003) and Winarsi (2007) that the tempeh contain antioxidants in the form of the isoflavones daidzein, glisitein, genistein and Factor 2. These substances may play a role in stopping the formation of free radical reactions, radical capture, that is by changing the superoxide radical, the reaction catalyzed by dismutasi. Carrot is able to reduce F₂-Isoprostan levels of Wistar rat, because beta carotene content of carrot is chain breaker antioxidant, lipophilic nature so act on the cell membrane to prevent lipid peroxidation, therefore non-cyclooxygenase oxidative modification of arachidonic acid that produces F₂-Isoprostan (Patrono, 1997; McMichael, 2004).

F₂-Isoprostane levels were lower in subject who consumed antioxidant supplements, such as vitamin E, and beta carotene. Antioxidants are able to inactivate oxidation reaction, by preventing the formation of radicals. Antioxidants are compounds that can also inhibit the oxidation reaction by binding to free radicals and highly reactive molecules (Surjohudojo, 2000). Confirmed also that content of the thyroid in tempeh increase the usability of beta carotene. Availability of beta carotene increased with the presence of vitamin E and other antioxidants (Sunita, 2009). Various studies have found that tocopherol (α or γ) protects beta carotene from autooksidasi (Palozza and Krinsk, 1992).

Tempeh isoflavones can suppress the formation of IL-6, direct inhibition of the reaction pathway signal transduction. Unsaturated fatty acids Omega-3 in tempeh can reduce the secretion of proinflammatory cytokines. Omega-3 supplementation for 18 weeks inhibited signaling in basal and lipopolysaccharide (LPS), which stimulates the production of IL-6 or monocyte (Abbate *et al.*, 1996; Sunita, 2009). Tempeh can increase blood plasma thyroxine levels, there by reducing the level of inflammation (Simanjuntak and Sudaryati, 1998).

Tempeh also contain estrogen that can regulate the production of IL-6 (Rifas *et al.*, 1995). Affirmed by Manolagas (1995) and Keller *et al.* (1996) that estrogen inhibits IL-6 gene expression, through repression of transcriptional activation of the IL-6 gene effects through estrogen receptors in transcriptional activity of the proximal 225-bp sequences of the promoter. Isoflavones found in tempeh, can mimic the role of the hormone estrogen (Baziad, 2003 Omoigui, 2007).

Vitamin C content of carrots provide anti-inflammatory role (Esvandiary *et al.*, 2007). Barriers to oxidation of arachidonic acid and neutralizing reactive oxygen causing anti-inflammatory effect of beta carotene. IL-6 receptor is controlled by vitamin A (Parakkasi, 1999). The research of Utami and Wijoyo (2007) mentions that carrots have significant anti-inflammatory power.

Histopathologic test combination fresh tempeh with carrots showed without foam cells and fatty streak, this happens because the full content of this food antioxidant combination (Ari Agung, 2013), this is in accordance with the opinion Widowati (2007) that the body's antioxidant system as a protective mechanism against the body free radical attack consists of many components, such as SOD, GPx, catalase and extracellular antioxidants. One component of food shortages led to a decline in the status of the overall antioxidant status so that the protection of

the body against free radicals is reduced, which means the higher the risk of atherosclerosis. Tempeh contains two types of protein, namely 11 S globulin (glycinin) and 7 S (β -conglycinin). 11 S protein (glycinin) have a role as an antioxidant (Torres *et al.*, 2006). Protein 7 S (β -conglycinin) has been reported to reduce the accumulation of cholesterol in the aorta, so as to prevent CHD. Linoleic acid and linolenic acid are not only needed for all of the cell membrane but also experience and denaturation elongasi a longer chain and is a component of eicosanoid precursors that mimic hormones, prostaglandins and leukotrienes. linoleic acid is converted to arachidonic acid, whereas linolenic acid is converted to eicosapentaenoic acid (EPA) and decosahexosenoic acid (DHA) (Mann and Stewart, 2007). EPA and DHA can prevent blood platelets. Platelets in the blood in large quantities will interfere with blood flow and is a major cause of heart attacks and strokes. Tempeh contain high enough vitamin B12, which is negatively correlated with serum homocysteine, homocysteine levels lead to an increase in hydrogen peroxide, giving rise to the risk of damage to endothelial cells and platelets at the onset of blood vessels will lead to a stroke or CHD (Utari, 2011). Beta carotene in carrots may help prevent plaque or cholesterol deposits in the blood vessels, so it is often referred to as antistroke (Mayes, 2002).

The results of study by Ari Agung (2013) show that supplementation with a combination of tempeh with carrots can cause changes in the aortic histopathologic of Wistar rat endothelial dysfunction and fatty streak (atherosclerosis) become normal.

3. Conclusion

Potency antioxidant of fresh tempeh such as protein (glycinin dan β -conglycinin), beta caroten, vitamin E, B2, Omega-3, , Zn, Cu, Se, Fe, Isoflavons (Genistein, Daizein, Glisitein and Factor2), SOD, can significantly increase the prevention of atherosclerosis with addition of vitamin C.

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