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INTRODUCTION AND AIMS

Rearing laying hen is an occupation that make income for some groups of people. At present, the growth of laying hen industries in Thailand decreased dramatically due to the outbreak of Avian Influenza in 2003 but the situation on number of laying hens improved gradually. Eggs are essential in terms of a cheap and valuable protein source. However since consumers preoccupied with coronary heart disease were increased particularly from consuming high cholesterol in food, this resulted in a decreased consumption of eggs especially in adult. Egg contains high cholesterol concentration that can increase risk on coronary heart disease and atherosclerosis (Riemersma et al., 1991). Currently, people have an increase concern in cholesterol and quality of nutrition of egg as well as modification in nutritional characteristic and quality egg improvement.

Egg proteins are easily digested, high quality protein, which contain many essential amino acids especially lysine and methionine. Special eggs were also available in the market (Labier and Leclerreq, 1994) with increasing quality egg like alpha–linolenic acid (omega-3), vitamin E, iodine, selenium and low-cholesterol eggs (Buckley et al., 1995; Cherian et al., 1996a; Meluzzi et al., 2000). Eggs with high vitamin E had many advantages for instances antioxidant, cancer protection, anti-aging, reduced risk of atherosclerosis, cataract protection, immunostimulant and reduced inflammation of wound (วิญญารัตน์ ตันศิริ, 2540) and improved reproductive system (Grandhi et al., 1993). Vitamin E deficiency lead to testis withered and rapidly seminiferous tubule deterioration in rat and vitamin E supplementation can reduce abortion of rats (ประสาน มานิตพิสิฐกุล, 2530 ก, ข).

Griffin (1992) reported that concern on cholesterol content of the human diet has led to many attempts to reduce the cholesterol content of eggs. Although, this report had involved a numbers of different approaches, including genetic selection and nutritional or pharmacological manipulation, the overwhelming evidence was that egg yolk cholesterol level was very resistant to change. The current review argues that this is because of the

particular mechanisms involved in yolk formation. Yolk precursors are synthesized in the liver of the laying hen and transported in the plasma to the ovary where they are taken up into the developing follicles by receptor-mediated endocytosis (Griffin et al., 1985). As a consequence, the cholesterol content of yolk is primarily dependent on the cholesterol content of triglyceride-rich lipoproteins. Studies in mammals have shown that inhibition of cholesterol synthesis can reduce the rate of synthesis and secretion of lipoproteins by the liver, but has little effect on the composition of the lipoproteins that are secreted.

Concern about the relationship between dietary fat and the development of atherosclerosis has led to publication of number of reports encouraging changes in the human diet. These have included recommendations for the reduction in the total fat content, in the ratio of saturated to unsaturated fatty acids and in intake of total cholesterol to less than 300 mg/day (Brown, 1990; Cannon, 1990). Each egg contains about 200-250 mg cholesterol and the perception of eggs by the public as a major source of dietary cholesterol is seen as a significant factor contributing to the overall decline in their composition (Yaffee et al., 1991).

The relationship between vitamin E and antioxidant showed that both vitamin E and other antioxidants could reduce the incidence of coronary heart disease. Therefore, consumption of supplemented antioxidants increased, especially vitamin E. Jialal and Grundy (1992) reported that sensitivity to low-density lipoprotein (LDL) oxidation can prevent atherosclerosis. In nature, vitamin E is divided into 2 groups, namely tocopherol and tocotrienol. Tocotrienol was less bioavailable and can be absorbed after intake at the lower rate than tocopherol (Azzi et al., 1993; Cherian et al., 1996b; Grobas et al., 2002; Jialal and Grundy, 1992; Jiang et al., 1994; Nobile and Irving, 1996). It is demonstrated that there were few research on effect of supplementation of tocotrienol in a form of natural product in animal particularly laying hens. Tocotrienol had more antioxidant properties than tocopherol and had an ability to reduce cholesterol concentration. In addition, tocotrienol could be used as an antiproliferative agent of cancer cell (Azzi et al., 1993) and a neuroprotective agent of brain cell (Murphy et al., 1990; Packer et al., 2001). Therefore, it is interesting to investigate more on the effect of tocotrienol in food-producing animals such as laying hens.

High concentrations of tocotrienol are found in palm oil and rice bran (Theriaulth et al., 1990). Other natural sources include coconut oil, cocoa butter, soybean, barley and wheat germ. Moreover, tocotrienols can be detected in meat and eggs. Sunflower, peanut, walnut, sesame and olive oils, however, contain only tocopherols (Heinonen and Piironen, 1991). In palm oil industries, palm oil was refined for consumption and their by-product, palm kernel, was used to rear animals (Ab Gapor, 1990; Berger et al., 1980). In some season, there are excess supply of palm and this oversupply the capacity of the factory to distill and purify palm oil for human consumption. This results in the over production of crude palm oil in the market. Therefore it is of interest to use crude palm oil from squeezed palm that is riches in tocotrienol to supplement in diet of laying hens. It is proposed that both tocotrienol and tocopherol could be transferred to egg. This can increase consumption of the antioxidant vitamin E in human via conventional food chain. Moreover eggs riches in tocotrienol will be beneficial in reducing yolk cholesterol apart from being an antioxidant, neuroprotective and anti cancer agents. It is also interesting to examine the distribution of tocotrienol in palm oil to various tissues of laying hens.

The objective of present study was to examine the effects of crude palm oil supplementation in laying hen diet on tocopherol and tocotrienol concentrations in blood, adipose tissue, liver and egg yolk. Moreover the effects of tocotrienols in crude palm oil on cholesterol concentrations in egg yolk, egg performance, hen performance and egg quality were investigated.