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# THE EFFECT OF GREEN TEA EXTRACT (CAMELLIA SINENSIS) ON THE NUMBER OF FALLOPIAN TUBE EPITHELIAL CELLS IN FEMALE WHITE RATS (RATTUS NORVEGICUS) EXPOSED TO MSG (MONOSODIUM GLUTAMATE): A LITERATURE REVIEW

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**ABSTRACT**

Most green tea contains catechins which function to control the amount of free radicals by binding to reactive oxygen species (ROS). To determine the effect of green tea extract (Camellia sinensis) on the number of fallopian tube epithelial cells in female white rats (Rattus norvegicus) that have been exposed to MSG (Monosodium Glutamate) with a literature review approach. This study used a literature review using the Systematic Literature Review method. There were 10 journals that discussed the effect of green tea or other antioxidants on the number of fallopian tube epithelial cells in female white rats (Rattus norvegicus) that had been exposed to MSG (Monosodium Glutamate). A total of 10 journals used in this literature review, showed that the effect of MSG and cypermethrin on Fallopian tube epithelial cells in experimental animals can significantly cause cellular hypertrophy of epithelial cells in the fallopian tubes, degenerative changes, atrophy and distortion of the basement membrane that separates the endosalpinx from myosalpinx.

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**Keywords:** Green Tea, Catechins, Msg, Fallopian Tubes, Fallopian Tube Epithelial Cells.

## INTRODUCTION

Infertility is "a disease" or a problem in the reproductive system, especially in women. Infertility can also mean sexual intercourse between men and women without protection which fails in pregnancy after 12 months (Khizroeva et al., 2019).

Currently, infertility has become a problem at the world level, which causes more than 81 million people, with a percentage rate of 15%, to be married couples. In 41 years, the increasing incidence of infertility cannot be controlled (Meuleman et al., 2009). According to WHO, in 2012, around 51-81 million married couples in various parts of the world experience infertility. Infertility is higher in developing countries like India, around ~33%, compared to developed countries like America, which is only around 6-9% (Daftuar, 2016). In Asia, it was found that the prevalence of infertility occurred in Cambodia at 31%, Kazakhstan at 11%, Turkmenistan at 44%, and Indonesia at 22% (Kumar et al., 2022). Riskesdas (2013) states that Indonesia has an infertility rate of 16-20%, with a total of 50 million in 2013.

One of the factors that can cause infertility is an unhealthy lifestyle from the habit of consuming foods that contain excessive MSG. MSG (Monosodium glutamate) is a compound that increases the umami taste of food. The prevalence of people with consumptive behavior towards MSG in the world is very high, especially in Indonesia, which can consume around 0.7 gr/day of MSG per day, Taiwan with a daily MSG consumption rate of around 3 gr/day, Korea with a daily MSG consumption rate of around 2.3 gr/day (Abdulghani et al., 2022). India and America only have a daily MSG consumption

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ratio of about 0.4 gr/day. Meanwhile, China is the country that consumes and produces the most MSG in the world, reaching 52% - 57%, which is the largest amount in any part of the world (Herforth et al., 2019).

MSG consumption limit, according to JECFA (Joint Expert Committee on Food Additives), which is WHO's trust division regarding the problem of MSG additives in food, states that the limit level for humans to consume MSG per day is 121 mg/kg of body weight. So if a person weighs 55 kg, he should consume at most 6 grams of MSG or about two teaspoons daily (Thongsepee et al., 2022). Consuming large amounts of MSG can increase the level of toxicity in the body and cause oxidative stress (Noor & Mourad, 2010). Oxidative stress significantly impacts the female reproductive system, especially the fallopian tubes. Vasilopoulos et al., (2018) stated that as many as 27.3% of infertility problems occurred due to interference with the function of the fallopian tubes. The role of the reproductive organs of the fallopian tube is to transport fertilization between the sperm and the egg (Mahdavinezhad et al., 2022). This role is influenced by the multicellular movement of epithelial cells originating from the infundibulum, which assists in egg retrieval and transportation (Li et al., 2018). If the fallopian tube is damaged or damaged, it can cause infertility.

Green tea is known to have high antioxidant content. Green tea contains mostly polyphenols, namely flavonols, commonly known as catechins (Bharti & Singh, 2020). The most important type of catechin in green tea is EGCG (Epigallocatechin-3-Gallate). These catechins function as protectors of the body's organs due to reactions to oxidative stress, along with vitamins that can stimulate an increase in antioxidants to minimize oxidative stress reactions (Bhatti et al., 2022). Antioxidants then play an important role in reducing free radicals, which can cause damage to cell wall membranes because they easily bind to reactive oxygen species (ROS) (Rosanti & Abu Seman, 2019). Based on this review, a study was carried out with the help of a literature review approach to determine the effect of green tea extract (Camellia sinensis) on fallopian tube epithelial cells in female white rats (Rattus novergicus) exposed to MSG.

## METHOD

This study has a design approach in the form of a literature review. This method is related to the current situation, namely the Covid-19 pandemic, which has limited researchers in collecting data. The data source for this research comes from secondary data obtained based on indirect observations. The data were obtained from a review of journals with a minimum level of three or three Scopus-indexed international journals, both from the Q1-Q4 level. This literature review study was carried out from August 2020 to May 2021. In this study, researchers analyzed the effect of green tea extraction on the fallopian tube epithelium in rats exposed to MSG.

Ten journals were used in the study with inclusion criteria including (1) Journal publications have a minimum span of 10 years (2012-2022). Journals are original research articles (not review articles), and the full text is available. (2) Using subjects, namely rats, mice, or humans (mammals). (3) Journals found discussing the content of green tea extract or other plants containing catechins, polyphenols, flavonoids, or other antioxidants on fallopian tube epithelial cells exposed to MSG. Then the results of the analysis of all journals that met the inclusion criteria were synthesized and presented in the form of a PICO-T table (Population, Intervention, Compare/intervention, Outcome, Time).

## RESULT AND DISCUSSION

Ten journals used in this literature review study met the inclusion criteria. A total of 4 journals discussed the effect of giving antioxidants (green tea, broccoli, vitamins C and E) on the number of fallopian tube epithelial cells exposed to MSG (3 journals) and cypermethrin (1 journal) in mice. One journal discussed the administration of antioxidants (Curcuma) on vaginal epithelial thickness in experimental animals exposed to MSG.

A total of 5 journals focused on discussing the effect of MSG on the number of fallopian tube epithelial cells in mice without giving

antioxidants. The studies used in this literature review, on average, in Asian countries, namely four studies in Indonesia and five studies in Pakistan, and African countries, namely, there is one study in Nigeria. The research design of the ten journals used in this literature review is that all use experimental studies.

**Population/ Study Sample Characteristics**

The sample in the ten journals used in the Literature Review is an average of healthy female rats aged 1-3 months with a body weight of around 150-500 grams. The average length of research is around 14-40 days.

**Intervention Method**

Giving exposure to MSG, cypermethrin, and antioxidants (green tea, broccoli, Curcuma, vitamin C, and vitamins C and E) to rats is usually given orally. Dosage The average MSG exposure is given a dose of 0.7-1.5 mg with or without distilled water. The dose of cypermethrin in experimental animals was as much as 250 mg. Each dose of antioxidants given to experimental animals was different.

**Results of Data Synthesis**

Overall, from the results of this study, there were ten journals used in this literature review, indicating that the effect of MSG and cypermethrin on the number of fallopian tube epithelial cells in experimental animals can significantly cause cellular hypertrophy of epithelial cells in the fallopian tubes, degenerative changes, atrophy, and membrane distortion. Basalis that separates the endosalpinx from the mesosalpinx.

Four journals state that giving antioxidants to fallopian tube epithelial cells exposed to MSG in experimental animals significantly increases the number of fallopian tube epithelial cells. One journal shows that giving antioxidants (Curcuma) to vaginal epithelial thickness in experimental animals exposed to MSG has no effect significantly.

**Effect of MSG on Fallopian Tube Epithelial Cells**

There were nine journals used in this literature review, showing that the effect of MSG on the number of fallopian tube epithelial cells in experimental animals significantly reduced the number of fallopian tube epithelial cells. In addition, the effect of MSG on the fallopian tubes can cause cellular hypertrophy of epithelial cells in the fallopian tubes, degenerative changes, atrophy, and distortion of the basement membrane that separates the endosalpinx from the mesosalpinx.

Excessive administration of MSG causes a decrease in the working system of the hypothalamus GnRH (FSH and LH), causing an imbalance in the hormones estrogen and progesterone. The estrogen hormone then stimulates the growth of the ovarian follicles and stimulates smooth muscle peristalsis of the fallopian tube epithelial cells, while the progesterone hormone inhibits the peristalsis. Estrogen has a significant negative effect on minimizing the secretion of the FSH hormone (Muchsin R, 2009). An imbalance can cause changes in the function of the fallopian tubes, which inhibit the function of reproductive hormones.

In addition, MSG can trigger cell organ dysfunction due to excessive oxidative stress on fallopian tube epithelial cells. The occurrence of cellular hypertrophy of epithelial cells can be associated with increased levels of estrogen. MSG increases estrogen levels by activating enzymes (aromatases), which catalyze the change of androgens into estrogens because the epithelial cells of the fallopian tubes are the most common place for egg fertilization and hypertrophy of epithelial cells. These degenerative changes can cause changes in the function of the fallopian tubes, which are the main cause of infertility in women (Ling et al., 2022).

One journal discusses the administration of cypermethrin can cause impaired proliferation of epithelial cells in the fallopian tubes. This is because cypermethrin produces excess oxygen in the liver, which causes ROS reactions in mammals. As a result of the ROS reaction with the cell wall causes damage to lipids, proteins, and DNA, causing brain cells and reproductive organs to die (Yahyazadeh et al., 2018). The results of this metabolism are due to increased free radicals in the body. Cell apoptosis is caused by the inability of endogenous antioxidants as the first line of defense to provide resistance resulting in oxidative stress. Increased cell apoptosis can lead to an impaired proliferation of fallopian tube epithelial cells (Liu et al., 2015).

**Effect of Green Tea Extraction on Fallopian Tube Epithelial Cells Exposed to MSG**

Three journals discuss the effect of Vitamin C, Vitamin E, Broccoli Ethanol Extract, and Curcuma as antioxidants on Fallopian Tube and Vaginal Epithelial Cells injected with MSG in research conducted by (Adinugroho et al., 2022; Greening et al., 2015; Kochman et al., 2020), exposure to MSG has an impact on significantly decreased the number of secretory epithelial cells and histological changes in the fallopian tubes and epithelial cells in the vagina, with the administration of antioxidants the number of secretory epithelial cells and the thickness of the smooth muscle of the fallopian tubes increased significantly. However, there is one journal Nurdin, (2018) that shows the result that the administration of Curcuma extract (Curcuma Xanthorrhiza Roxb.) in various doses did not significantly affect the increase in vaginal epithelial thickness in MSG-injected mice (Mus musculus). This is because Curcuma, as an antioxidant, has no effect and is not as good as vitamin C.

The way to determine if a sample can effectively minimize the presence of free radicals is based on the DPPH (2,2 diphenyl -1-picrylhydrazyl) approach, namely the IC50 method. IC50 with a certain concentration can minimize the level of DPPH free radicalization by up to 50%. When DPPH has a low level of IC50, it harms its antioxidant activity in the sense that it is higher (Le Bris & El Asri, 2016). According to Maizura et al., (2011), the potential of Curcuma extract as an effective antioxidant indicates that the antioxidant activity of Curcuma extract is not as effective as vitamin C. In Curcuma extract, IC50 was found to be 87.01 ppm compared to 1.47 ppm in vitamin C. When the concentration of IC50 is lower than an ingredient, then the level of antioxidant activity will be higher. This is consistent with the results of the research conducted above, where Curcuma extract did not significantly influence the level of free radicalization in the thickness of the vaginal epithelium of mice exposed to MSG because it has a high level of IC50, which causes low antioxidant activity.

According to Aboubakr et al., (2021), catechin polyphenols are the most effective antioxidants for fighting free radicals. Catechin polyphenols are believed to be the most important active components in green tea. Catechin polyphenols are secondary metabolites with antioxidant activity levels up to 21 times higher than vitamin C. Catechins in green tea are believed to minimize free radicalization levels through their ability to bind to ROS reactions to reduce oxidative stress levels.

In research on giving green tea to fallopian tube epithelial cells exposed to MSG, research conducted by Hamza & Diab, (2020) showed that there was a significant effect of the number of epithelial cells in the fallopian tubes on variations in green tea extraction doses. Green tea with high polyphenols can minimize the free radicals that cause infiltration (Adinugroho et al., 2022). According to Mahmood in 2015, green tea also has excess antioxidants, so it helps the body neutralize the hydrogen peroxide groups that cause hydroxyl radicals. The polyfill content in green tea can neutralize radicalization through the presence of the -OH functional group, which causes the radical compound to have a stable state.

Furthermore, the positions of the hydroxyl and ketone groups make it easier for the H+ ion bonds in hydroxyl compounds to bind to metals, thereby minimizing free radicalization and lipid peroxidation. According to (Bharti & Singh, 2020), the role of green tea as an antioxidant is that it can encourage interstitial theca cells and steroidogenesis, regulate the growth and development of follicles and follicular atresia, and can indirectly apply pressure and touch to ovarian follicles. The development of follicles can trigger the growth of epithelial cells.

## CONCLUSSION

The overall results of this study stated that the administration of green tea and other antioxidants to the number of fallopian tube epithelial cells exposed to MSG in experimental animals could significantly increase the number of fallopian tube epithelial cells. These results follow the theory that antioxidants such as green tea, broccoli, and vitamin C have a good effect on histologically repairing the fallopian tubes exposed to MSG and can increase the number of fallopian tube epithelial cells because antioxidants can reduce oxidative stress obtained from MSG. One journal shows that the administration of antioxidants (Curcuma) on the thickness of the

vaginal epithelium in experimental animals exposed to MSG did not have a significant effect.

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