



Role of *Ginkgo biloba* in Some Biological Functions of Female College Students

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Received: 10 June 2022

Accepted: 25 July 2022

Published: 05 Feb. 2023

ABSTRACT

This study was aimed at describing the role of *Ginkgo biloba* in some biological functions of female college students. **Material and methods:** Forty female college students participated to the study. G (1) control (n=20) received placebo, G (2) experimental received 300 mg/once daily for 8 weeks of *Ginkgo biloba*: 10ml of Venous blood was drawn into test tubes for examination of clotting tests, glutamine b-endorphin, IGF, and NO together with T. leukocytes, Lymphocyte, Neutrophils. **Results:** revealed a significant changes in biological functions post *Ginkgo biloba* administration compared to control. Conclusion: *Ginkgo biloba* showed encouraging improvement in clotting tests, also higher flow of blood to the important organs specially brain, with better mood and brain functions, and promote immune health.

Keywords: *Ginkgo biloba*, biological functions, female students, immunity, health, blood flow to organs

1. Introduction

As reported by Hefnawi, (1998) is one of the important element in drug manufacture and used definition of the herb: is any part of a plant, which can be used as a medical treatment, nutrient, food seasoning or dye. and used to enhance performance and as drugs due to its many contents:

- To cleanse the body.
- Adaptation to stress.
- Nutritional value.
- Source of energy.
- Stimulate immunity.
- Stimulate some organs such endocrine system, muscles.
- Source of low fat food.
- Antioxidants such as green tea and *Ginkgo biloba*.

Ginkgo biloba is an herb which native to China and Japan. It is old tree lives over 1000 years. Active component of Ginkgo leaves are quercetin and flavo glycosides. Ginkgo extract may:

- 1- Reduce clots and thrombi in veins and arteries.
- 2- Energy production of ATP.
- 3- Scavenger of free radicle.
- 4- Promote blood flow (especially to the brain).
- 5- Reduce blood pressure.
- 6- Improve alertness, short term memory and cognitive disorders that make the herb suitable to the high school student and older adults (Yaser, 1998).

John, (2021) added some functions to Ginkgo Biloba as an herb used to treat some diseases such as cognitive disorders, elterny diseases such as dementia, decrease cerebral blood flow, memory loss, or erectile dysfunction. It is taken and is available in relation to the cases of diseases from 120-300 mg daily orally for two to three months some researchers claims that it may be used to inhibit cancer, antiaging or overcome depression and improve vision, together with enhancing memory and shields the heart and may help support skin, memory, auditory health and blood flow.

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Some researchers also added that *Ginkgo biloba* is rich in antioxidants and reduce inflammation and may be beneficial for heart, brain, eye. Also reduce nervous system disorder and anxiety, dementia improving blood flow to the brain and help Alzheimer cases and brain function and welling and many other cases in animal and human.

Studies and some research evaluated the effect of Ginkgo on vision and eye health others on the effect on headaches and migraines and others indicated the improvement on respiratory diseases, and sexual dysfunction. About the dose of Ginkgo may be taken 120-160 mg divided throughout the day and not exceed 600 mg/day (Berkeley, 2014; Brondino, 2013; Cane Vellie, 2014).

Mckinly and Johnson, (2004); Brunton *et al.* (2008) reported that Hypothalamus is an important part of the brain and is part of the anterior end of diencephalon and is divided to a variety of nuclei and nuclear area. The hypothalamus functions with the limbic system of the brain as a unit that regulates emotional and instinctual behavior.

There are neural connections between the hypothalamus and the posterior lobe of the pituitary gland and vascular connection between the hypothalamus and the anterior lobe of the pituitary. Hier with some functions of the hypothalamus:

Temperature regulation, neuroendocrine control of catecholamine, TSH, ACTH, prolactin and behavior like thirsts, hunger, sexual behavior and defensive reaction like fear and rage.

(Franco Viviani, 2006) added that limbic system mean the neuronal circuitry that controls emotional behavior and motivation drives and hypothalamus is a major part of the limbic system, and psychobiology (PB) is a branch of psychology that study the relation between behavior and the body, which added also the brain. As PB relates behavior with body activity and including the brain, its aim is understanding the relation existing between behavior, experience and the biological substances.

It is well known that the nervous system receive information about changes in the internal and external environment, and that may affect hypothalamus which in turn stimulate the secretion or decrease the secretion of hormones from the pituitary that affect all organs and system of the body. The deviation from the physiological signs may manifest pathological effect that need physician interference through drugs or using herb treatments as recorded by many investigators (Canevelli, 2014; Arlin, 2022).

Study problem

It is important to protect the external environment from pollution. As well as the internal environment of the human body from pollution that affect the internal organs such as diet, drugs and others, that may induce diseases. In order to protect the internal environment from diseases, there are normal therapy and complementary or alternative therapies, which concentration on the body energy, and there are equipment to assess energy such as electromyograms and electrocardiogram, which determine energy, alternative therapies are mentioned as: physical, psychological, manipulative, behaviorism, transactional analysis, oriental, exercises movement, sensory, paranormal, Para national and herbal medicine (Yaser, 1998).

The aim of the study was to investigate to identify the possible role of *Ginkgo biloba* in some biological functions of female college students.

2. Materials and methods

2.1. Subject

Forty female subject volunteered to the study they were college students at Port Said Univ. All participants were free from diseases, healthy. They did not receive any supplements. They were divided to two equal groups. Control (n=20) received placebo once daily for 8 weeks. Experimental (n=20) they received *Ginkgo biloba* 300mg/once daily for 8 weeks. 10ml of venous blood was withdrawn into test tubes for lab-examination. All participants were fasting 8 hours before blood collection:

- Bleeding time using lancet to assess time of bleeding.
- Clotting time of blood in clean glass test tube, to the tube back and forth every 30s until the blood has clotted.
- Prothrombin time using the method described by (Guyton, Hall, 2006).
- NO was measured by nitrite / nitrite products via griess reaction using kit (R&D).
- Glutamine, b-endorphin, IGF(1) were determined by Elisa method.
- T. Wbcs, lymphocyte, neutrophils, platelets using Coulter Counter.

Table 1: Basic characteristics of the participants

Variables	Mean	SD	Skewness
Age(y)	21.3	3.4	0.28
Height(cm)	171.1	9.1	-0.12
Weight(kg)	69.3	10.3	-0.15
BMI (kg/m ²)	22.1	2.4	-0.56

Skewness between (±3) meaning the sample free of default of distribution

2.2. Statistical analysis

Using (SPSS) statistical package

For social scene for mean, standard deviations. T test for analysis of the results of pre-post experiment. P<0.05 value was considered statistically significant.

3. Results

Table (2) showed that *Ginkgo biloba* induced a significant increase in blood clotting tests for the sake of experimental group indicating an improved effect on clotting.

Table (3) showed that *Ginkgo biloba* administration induced a significant increased glutamine, b-endorphins, IGF(1) and NO, compared to control group, meaning better mood and brain function, high blood flow.

Table (4) showed the effect of *Ginkgo biloba* on immune cells, which increased significantly after the administration compared to the control group denoting positive effect on the immune system and health condition.

Table 2: Blood clotting of the control, experimental groups, pre-post placebo and *Ginkgo biloba*

Variables	Control		Experimental	
	Pre	Post	Pre	Post
Platelets counts 10 ³ /ul	203.1 ± 9.4	204 ± 10.2	205.2 ± 9.6	217.3 ± 10.6*
Bleeding time (min)	2.4 ± 0.05	2.37 ± 0.06	2.42 ± 0.07	3.9 ± 0.08*
Clotting time (min)	6.53 ± 0.09	6.57 ± 0.08	6.52 ± 0.07	8.12 ± 0.09
PT (sec.)	12.12 ± 0.15	12.3 ± 0.16	12.35 ± 0.12	14.5 ± 0.13*

P< 0.05

Table 3: Glutamine, b-endorphin IGF₍₁₎ and NO in case of control and experimental groups pre-post treatment

Variables	Control		Experimental	
	Pre	Post	Pre	Post
Glutamine (MM)	482.3 ± 19.3	473.1 ± 17.2	490.4 ± 20.6	581.2 ± 16.2*
b-endorphin (pg/ml)	41.3 ± 6.2	44.1 ± 5.1	39.9 ± 6.3	66.4 ± 5.4*
NO nitrite (mmol/ml)	27.4 ± 2.4	29.1 ± 1.8	26.5 ± 2.1	33.5 ± 1.7*
IGF1 (pg/ml)	10.3 ± 2.2	10.6 ± 2.5	9.8 ± 2.4	14.5 ± 1.9*

Table 4: T. Wbcs lymphocytes, neutrophil in control, experimental group, pre-post treatment

Variables	Control		Experimental	
	Pre	Post	Pre	Post
	M SD	M SD	M SD	M SD
T. Wbcs (10 ³ /ul)	6.8 1.3	6.9 1.2	6.7 1.4	8.1 1.5*
Lymphocyte (10 ³ /ul)	2.8 0.4	2.6 0.2	2.8 0.1	3.9 0.3*
Neutrophils (10 ³ /ul)	4.3 0.7	4.4 0.8	4.5 0.6	5.6 0.9

P < 0.05

4. Discussion

The data presented in table (2) revealed a significant change in blood clot which included platelets counts, bleeding time, clot time and Prothrombin Time (PT) post *Ginkgo biloba* administration for 8 weeks. The prolongation of bleeding and clot time may lead to decreased platelets ability to form thrombus (Lorenz *et al.*, 1983) while the prolongation of PT may be attributed to the reduction of some factors such as factor VII, X, which in turn retard clot formation (Le Ray *et al.*, 2001). Blood clot is

composed of a mesh work of fibrin which entrap blood cells, platelets and plasma. Also the fibers adhere to damaged surfaces of blood vessels. The clot also adhere to any vascular opening to prevent more blood loss as reported by Guyton & Hall, (2006) and Barrett *et al.*, (2010).

Then the clot retract within few minutes after the clot formation, as the clot retracts, the edge of the broken blood vessels are pulled together, thus contributing to further to the ultimate state of hemostasis (Brass, 2003).

The term hemostasis means prevention of blood loss. This is achieved by: vascular contraction, formation of blood clot, and growth of the fibrous tissue into the blood clot to close the hole in the blood vessel.

Levi, (2004) added that after a cut in the blood vessel the trauma to the vessel wall causes the smooth muscle in the wall to contract, which reduces the blood flow from the ruptured vessel, together with nervous reflex and then the hole is sealed by platelet plug.

Table (3) showed that *Ginkgo biloba* induced a significant increased glutamine, b-endorphin together with insulin growth factor and NO levels to the favor of the experimental group compared to control group. The increased NO induced angiogenesis and led to increased blood flow to the different organs of the body specially the brain, which improved brain function and other organs, and b-endorphin elevation improved the wellbeing and decreased pain together with improving the mood, and the increased glutamine level induced positive effect to the immune system with improvement in energy product of blood cells. The increased IGF₍₁₎, which is a neurotropic hormone and myogenic factor, promote myoblast proliferation, myogenic differentiation and hypertrophy of the muscle, it act with muscle satellite cells through the formation of myo fibers, and increased muscular mass and strength which in turn led to improve physical and mental performance.

This is in accordance with the studies of Florini *et al.* (1996); Mougios, (2006); Coleman *et al.* (1995); Jackson *et al.* (1996).

The effect of growth hormone on growth and protein metabolism depend on interaction between growth hormone and IGF₍₁₎ which in turn induced an integration with stem cells by stimulations of stem cells division and leading to hypertrophy of the muscle with increased muscle mass also IGF(1) accelerates muscle regeneration by modulating cytokines and chemokines (Laura *et al.*, 2007).

Paolo *et al.*, (2007) added that IGF₍₁₎, plays a crucial role in wound healing and tissue repair, as IGF₍₁₎ improve healing in collagenous tissue, and in muscle regeneration and cause muscle hypertrophy these effects are mediated by satellite cells and bone marrow stem cells. IGF₍₁₎ have an endocrine action as well as local expression resulting in autocrine and paracrine signally that induce tissue regeneration.

Noura, (2005) reported that Nitric oxide (NO) is formed in the body from amino acid arginine. It is a wonder molecule having diverse biological functions like PGs. Arginine is acted upon by an enzyme called "Nitrogen oxide synthase" a cytosolic enzyme and converts arginine to citrulline and nitric oxide (NO). functions of nitric oxide are summarized:

- It acts as vasodilator and relax smooth muscle.
- It has important role in the regulation of blood flow and blood pressure.
- Acts as neurotransmitter in the brain and peripheral autonomic nervous system.
- Inhibits adhesion, activation and aggregation of platelets.
- May constitute part of a primitive immune system and mediate bactericidal actions of macrophages.
- It is involved in penile erection.
- It is involved in the pathogenesis of atherosclerosis.
- This involved in angiogenesis (ChatterJea and Shinde, 2006).

Hatfiled, (2013) reported that glutamine promotes nutrients metabolism, together with protein synthesis as an important amino acid also stimulate growth by growth hormone production and stimulate immune system.

Newsholme and Parry, (1990) reported the importance of glutamine in relation to the immune system, by showing that the glutamine is used at a high rate by cells of the immune system and added that glutamine levels must be maintained as glutamine is an important element of fuel production for immunity cells specially lymphocyte.

Table (4) showed a significant increased T. Wbcs, Lymphocytes and neutrophils counts following *Ginkgo biloba* ingestion for 8 weeks compared with the control group, that indicated an increased immunity as the leukocytes are the mobile units of the body's protective system, they are formed in the bone marrow (granulocytes) and lymphocytes in the lymph tissues.

The increased Wbcs recorded following supplementation was also reported by Nathan Gray, (2015); Abdel Razek *et al.*, (2016); Mason, (2000); Hefnawi, (1998); Guyton and Hall, (2006) added that most of Wbcs are transported to areas of inflammation, and defend the body against bacteria and infections.

There is an important relation between nutrition and the immune system, because both lymphocytes and macrophages intake of energy by glucose and glutamine, and the utilization of both elements is high (25%), this is important for both purine and pyrimidine nucleotide synthesis that need glucose and glutamine for the proliferation of cells. The decrease in both elements may affect negatively lymphocytes and macrophage, hence the destruction of the immune system as reported by Schneider and Lavoix, (1990), because there will occur decrease antibody synthesis by lymphocytes and decrease rate of phagocytosis by macrophages. This denote the important role of *Ginkgo biloba* in increasing glutamine level and sustain immune system.

Farouk, (1998) reported the importance of supplementation of nutrients for athletes by showing that through ancient times, human being have tried to obtain strength and energy through nutrients specially amino acids, as example Ornithine, Lysine, Arginine to stimulate growth hormone, Branched Chain amino acids (BCAA) for energy production and endurance of cardiovascular system.

As for the amino acid glutamine, to stimulate the immune system and wellness, and minerals such as magnesium, potassium to improve physical performance for long distance athletic and creative for formation of creatine phosphate and ATP.

The human body has the ability to resist almost all types of organisms or toxins that tend to damage the tissues and organs. This capability is called immunity. Also, the immune system is adversely affected by stress, which tend to increase the susceptibility to diseases (Heshmat *et al.*, 2013).

Immunostimulants include a wide range of chemical agents, bacterial components. Polysaccharides, animal or plant extracts, nutritional factors and cytochines (Essam, 1998).

Of the important immunostimulants that may facilitate the function of phagocytic cells or stimulate antibody response are *Ginkgo biloba* (Hefnawi, 1998) he added also that we must return to nature that sustain our health.

Conclusion

In conclusion, it has been shown that *Ginkgo biloba* can affect immunity through acting on Wbcs to protect the body from infection. Also, it can induce improvement of the brain function by increasing blood flow to the brain and stimulate brain hormones. The study, throw the light for the action of *Ginkgo biloba* in improving the coagulation process to protect the body from heart and brain shocks.

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