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Full Length Research Paper

Effect of garlic (*Allium sativum*) and onion(*Allium cepa*) allicin extracts on the cholesterol in egg

***[1,2]Oguntoyinbo Segun Isaac, [1]Bello Temitope Kayode,[3]Oguntoyinbo Yetunde Grace And [4]Majekodunmi D. Michael**

[1]Department of Food Technology, Moshood Abiola Polytechnic, Abeokuta, Ogun State, Nigeria
[2]Department of Food Science, University of Pretoria, Faculty of Natural and Agricultural Sciences, Pretoria 0002, Republic of South Africa
[3]School of Nursing Ilaro, Ogun State
[4]Department of Food Technology, University of Ibadan, Ibadan, Oyo State, Nigeria
*Corresponding Author' e-mail: graceyetty2020@gmail.com

ABSTRACT

The effects of garlic and onion allicin extracts on the lowering of cholesterol in egg were studied. The garlic and onion allicin extracts were prepared and added to raw eggs in ratios 10:100, 30:100 and 50:100. Three eggs were boiled in separate containers with 250ml, 300ml and 350ml of garlic and onion allicin extracts, respectively. The results showed that 10ml, 30ml and 50ml of garlic and onion allicin extracts reduced the cholesterol in raw egg by 19.65%, 26.16%, 32.68%, and 9.68%, 12.09%, 15.70%, respectively, while 250ml, 300ml and 350ml of garlic and onion allicin extracts reduced the cholesterol in boiled egg by 39.19%, 43.54%, 50.05%, and 38.58%, 44.61%, 48.22%, respectively. The effects of garlic and onion allicin extracts on the proximate compositions of both raw and boiled eggs were significant ($p < 0.05$). This study reveals that an increase in the allicin content leads to a decrease in the dietary cholesterol level. The study also shows that both garlic and onion allicin extracts have direct effect on the proximate profile of egg. However, garlic allicin is slightly more effective and potent compared to the allicin in onion.

Keywords: Cholesterol, Allicin, Garlic, Onion, Proximate composition.

INTRODUCTION

Cholesterol is a fat soluble crystalline steroid alcohol that occurs as an essential constituent of animal cells and body fluids that is important in physiological processes (Gove, 1987). Cholesterol is a sterol produced by all vertebrate cells, particularly in the liver, skin, intestine and in nerve tissues (McGraw Hill, 1984). Cholesterol has been implicated experimentally as a factor in arteriosclerosis (narrowing of the arteries) that could lead to heart attack, stroke and other heart related diseases such as clogged arteries, blood clots and arterial blockage (Gove,1987). However, Cholesterol serves many functions in human being, especially in the brain and nerve tissues (Macrae, Robinson and Sadler, 1993). It appears to act as an insulator in the body. It also lubricates the animal skin. It is a precursor of a number of biologically important compounds such as corticosteroids, gonadal hormones and vitamin D. In fact, our body cannot function without this lipid compound (Macrae, Robinson and Sadler, 1993). It is synthesized in the body, especially in the liver and adrenal cortex.

There are two types of cholesterol-Serum and Dietary cholesterol (Macrae, Robinson and Sadler, 1993). Serum cholesterol is found in the blood stream produced by the liver, while dietary cholesterol is obtained from the food we eat. They both depend on the action of lipoprotein for their support since cholesterol and other lipids are transported in the plasma as part of a continuum of lipid protein complexes whose hydrated density is less than $1.21gm^{-1}$ (Macrae, Robinson and Sadler,1993).

Lipoproteins are of two types.Low Density Lipoprotein (LDL) and High Density Lipoprotein (HDL). The LDL contributes to the formation of plagues on the artery

Abbreviations

Mg = milligram, g = gram, ml = milliliter, % = percentage

walls. It is known as 'Bad Cholesterol' because it carries the fat from the liver into the blood vessel (Macrae, Robinson and Sadler, 1993), while HDL prevents the formation of clogs on the artery wall. It is referred to as 'Good Cholesterol'. Certain diets such as fish oil, oats, bran soybeans, apples, olive oil and herbs such as garlic, fenugreek seeds, cayenne and turmeric can lower the level of cholesterol.All animal products contain cholesterol in various degrees. Egg contains 500mg/100g of cholesterol (Ngoddy and Ihekoronye, 1985). Dietary fats have been estimated to have direct effect on the serum total cholesterol (Mensink, *et al*., 2003)

The mortality or death rate accrued to cardiovascular vascular diseases in the world is quite alarming. Cardiovascular diseases are usually caused by many factors such as diet (obesity), heredity, too much intake of alcohol, diabetes, and more importantly excessive intake of cholesterol. Hypertension (high blood pressure), diabetes and hyperlipidemia are among the factors responsible for cardiac diseases (Boden-Albala and Sacco, 2000). Various studies have focused on the ability of garlic to reduce cholesterol triglycerides and increases High Density Lipoprotein in the blood. A more recent review by Reuter (1995) analyzed 28 clinical studies on garlic based on design, test method, number of patients, duration of treatment, types of garlic consumed and dosage. Reuter's studies used healthy patients, patients with high levels of fats in the blood, those with high cholesterol in the blood, as well as patients suffering from hypertension, coronary heart disease, clogged arteries, and other related conditions. Blood lipid measurement included a decrease in total cholesterol, increase of high density lipoproteins, and decrease in triglycerides. When averaged together, the patients in the studies had a 10.3% decrease in cholesterol levels and 14.4% decrease in triglycerides. The author suggested that significant cholesterol or blood lipid lowering effect can be achieved with a daily dose of 600mg – 900mg of garlic powder, containing 3.6mg-5.4mg of allicin. There is need to investigate the amount of cholesterol ingested through the diet. Therefore, it is of utmost importance to investigate the effects of allicin extracted from food materials such as garlic and onion on the dietary cholesterol in egg.

MATERIALS AND METHODS

Preparation of materials

Garlic cloves (*Allium sativum*), onion bulb (*Allium cepa*) and eggs were purchased from four different markets in Abeokuta (Kuto, Lafenwa, Omida and Panseke).

Processing of garlic cloves and onion bulb

The modified method of Kim and Sok(1994) was adopted for the production of garlic and onion allicin. The garlic cloves and onion bulbs were sorted and washed at room temperature to remove dirt, dust and also reduce the microbial load. The cloves were then peeled with kitchen knife and blended using a blender (KENWOOD BL227) and filtered.

Sample preparation

Raw egg (100 ml) was measured into six conical flasks. Onion and garlic allicin extracts (10 ml, 30 ml, and 50 ml) were added to three flasks each, respectively and whipped until the mixture was homogenous.Whole eggs (58.9 g) were also boiled for 15 min with 250ml, 300ml and 350ml onion and garlic allicin extracts.

Chemical analysis

The blends were analyzed for proximate composition according to standard methods (AOAC, 1990). The conversion factor for relating kjeldahl nitrogen of the sample to protein content was calculated on the basis of the proportion of total protein provided by each of the protein containing constituents. Total solids, moisture content and cholesterol were determined using AOAC (1990).

Statistical analysis

The data were subjected to one-way analysis of variance (ANOVA) using the IBM SPSS software version 15 and the means separated using the Least Significance Difference test (LSD).

RESULT AND DISCUSSION

Table 1 shows the effect of garlic allicin extract on the proximate compositions of raw and boiled eggs. Garlic allicin extract increased the protein content by at most ≈ 9 %. This might be due to proportional effect of cholesterol reduction by the extract.

The fat content, however, decreased by 12 %. This suggests that the more the allicin extract, the lower the fat content. A study by Macrae, Robinson and Sadler (1993) revealed that those whose diet contained a large portion of saturated fat exhibited a higher average cholesterol level and a higher incidence of coronary disease. The ash content showed an increase from 1.03% to 1.87%. The increase might be as a result of the additional mineral elements from the extracts.Moisture content decreased by 25 %. The movement or loss of water from a food material depends on the condition of the food material (Oguntoyinbo *et al*., 2015). The

Table 1. Effect of garlic allicin extract on proximate composition of raw and boiled eggs

Treatment	Protein (%)	Fat (%)	Ash (%)	Total solids (%)	Moisture content (%)
Raw egg	11.73± 0.20 ^{g}	14.26±0.01^{a}	1.03±0.09^{g}	30.17±0.23^{g}	69.83±0.09^{a}
A	12.60± 0.11^{d}	13.89±0.10^{b}	1.07±0.13^{f}	31.46±0.13^{f}	68.54±0.04^{b}
B	13.14± 0.15 ^{b}	13.64±0.13^{c}	1.10±0.21^{e}	33.65±0.08^{e}	66.35±0.21^{c}
C	13.65±0.03 ^{a}	13.48±0.21^{d}	1.24±0.06^{c}	35.74±0.18^{d}	64.26±0.11^{d}
D	11.90±0.21 ^{f}	12.74±0.11^{e}	1.37±0.05^{d}	39.84±0.21^{c}	60.16±0.03^{e}
E	12.25±0.01^{e}	12.63±0.07^{f}	1.53±0.25^{b}	42.94±0.11^{b}	57.06±0.04^{f}
F	12.78±0.15^{c}	12.52±0.02^{g}	1.87±0.17^{a}	47.52±0.11^{a}	52.48±0.06^{g}

Mean values in the same vertical column with different superscripts are significantly different ($p < 0.05$)

Table 2. Effect of onion allicin extract on proximate composition of raw and boiled eggs

Treatment	Protein (%)	Fat (%)	Ash (%)	Total solids (%)	Moisture content (%)
Raw egg	6.43±0.23^{f}	2.23±0.22^{d}	0.55±0.27^{d}	14.91±0.13^{g}	85.09±0.22^{a}
A	11.16±0.32^{d}	5.23±0.32^{a}	0.74±0.02^{c}	22.26±0.11^{c}	77.74±0.24^{e}
B	8.87±0.15^{e}	4.86±0.11^{b}	0.65±0.33^{a}	19.65±0.12^{e}	80.35±0.34^{c}
C	5.85±0.04^{g}	4.72±0.04^{c}	0.65±0.13^{b}	17.02±0.12^{f}	82.98±0.13^{b}
D	16.94±0.03^{b}	1.22±0.03^{e}	0.66±0.25^{c}	21.58±0.24^{d}	78.29±0.27^{d}
E	20.58±0.02^{a}	0.88±0.21^{g}	0.76±0.22^{f}	23.74±0.33^{a}	76.25±0.23^{f}
F	15.94±0.04^{c}	1.06±0.03^{f}	0.70±0.25^{e}	22.33±0.25^{b}	77.67±0.21^{e}

Mean values in the same vertical column with different superscripts are significantly different ($p < 0.05$).

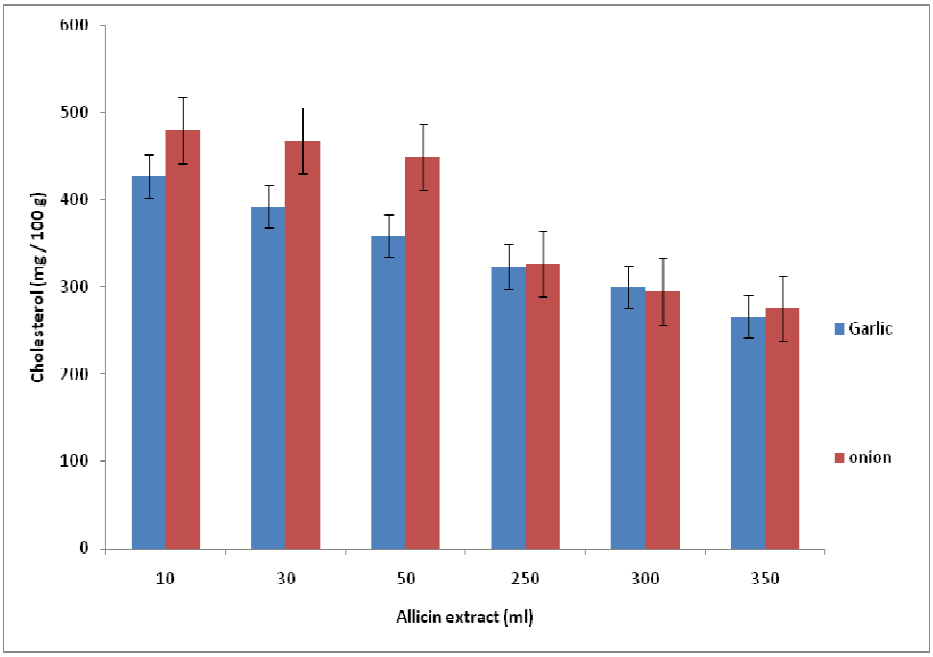

Figure 1. Effect of garlic and onion allicin extracts on egg cholesterol

decrease might be as a result of the water-holding capacity of the proteins in eggs, which decreases the hydrophobicity of egg protein molecules. This was further substantiated by Belewu (2000) who found out that inclusion of egg-white into fish muscle tissue decreased the moisture that could be expressed. The effects of onion allicin extract on the proximate compositions of raw and boiled eggs are presented in Table 2. Moisture decreased significantly with an increase in the quantity of onion allicin extract. The decrease might be as

a result of the water-holding capacity of the proteins in eggs, which decreases the hydrophobicity of egg protein molecules. Total solids increased by59 %, probably due to additional mineral elements from the extracts, while the fat content decreased by 83. The protein content increased by 69 %, while the ash content also increased by 38 %.

The results of garlic allicin on the cholesterol both raw and boiled eggs were significantly different ($p < 0.05$) from each other as shown in figure 1. Garlic allicin and onion extracts (10 ml, 30 ml and 50 ml) reduced the cholesterol level in the raw egg (532.31 mg / 100 g)by 20 %, 26%, 33 %, and 10 %, 12 % and 16 %, respectively. There was a reduction in the amount of cholesterol treated with 250ml, 300ml and 350ml by 39%, 44 %, 50 %, and 39 %, 45 % and 48 %, respectively. The reduction in cholesterol level was as a result of the active component “allicin” in garlic and onion. This finding is supported by the report of Kumar *et al*. (2010) that onion as a bulb contain sallicin that is anti-inflammatory, anti-cholesterol and anti-oxidant. Warchafsky *et al* (1993) concluded that between one half to one clove of garlic per day or an equivalent dietary supplement form reduces cholesterol level by a conservative range of 90%. A meta-analysis performed by McNamara (1985) showed that 100mg/100g change in dietary cholesterol would result in corresponding change of approximately 1.9mg/100g LDL-cholesterol and 0.4mg/100g change in LDL-cholesterol. This study demonstrated that dietary cholesterol does have a measurable but small effect on plasma cholesterol levels in that the plasma total/cholesterol results from increase in both LDL-cholesterol and HDL-cholesterol levels.This research work is not after reducing the serum or plasma cholesterol.

However, its utmost aim is to reduce the dietary cholesterol in egg, which contains the highest dietary cholesterol among the foods of animal origin. This is turn prevents any further increase in the blood, serum, or plasma cholesterol.These results suggest that garlic and onion allicin extracts are capable of reducing dietary cholesterol in egg to appreciable amounts.

A: 100 ml of raw egg with 10 ml of garlic allicin extract, B: 100 ml of raw egg with 30 ml of garlic allicin extract, C: 100 ml of raw egg with 50 ml of garlic allicin extract, D: 58.9 g of boiled egg with 250 ml of garlic allicin extract, E: 58.9 g of boiled egg with 300 ml of garlic allicin extract, F:58.9 g of boiled egg with 350 ml of garlic allicin extract

CONCLUSIONS

A study of the garlic and onion allicin extract added to the raw and boiled eggs reveals that an increase in the allicin content leads to a decrease in dietary cholesterol. The study also shows that both garlic and onion allicin extract have direct effects on the proximate composition of egg.

However, garlic allicin was slightly more effective and potent when compared to the allicin in onion. It has been recommended that an egg should be eaten per day to prevent an increase in serum cholesterol (Jyrki *et al*., 2016). From this study, two pieces of egg can now be taken since the garlic extract is capable of reducing the cholesterol level by half.

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REFERENCES

AOAC (1990).Official Methods of Analysis of the Association of Official Chemists (AOAC).12th Edition, Arlington VA, USA.27-30.

Belewu MA (2000). Microbial evaluation of indigenous milk products with special

Boden-Albala B, Sacco RL (2000). Lifestyle factors and stroke risk: Exercise, alcohol, diet, obesity, smoking, drug use, and stress. *Current Anthrosclerosis Reports*. 2(2): 160-166.

Gove IB (1987). Webster’s Third New Dictionary. A.B. Uni. of Kansas. New York State School Library. 397.

James CS (1996). Analytical Chemistry of Foods. Blackie Academic and Professional, an Imprint of Chapman & Hall, Wester Cleddens Road, Bishopbriggs, Glasgow G64 2NZ, UK. 2nd Edition. 73-74, 163-167.

Jyrki KV, Jaakko M, Heli EKV, Mikael F, Jukka TS, Timo TK, Sari V, Tomi-Pekka T (2016). Associations of egg and cholesterol intakes with carotid intima-media thickness and risk of incident coronary artery disease according to apolipoprotein E phenotype in men: the kuopioischaemic heart disease risk factor study. *American J. Clinical Nutri.*42:324.

Kim MR, Sok D (1994).Correlation between pungency and allicin content of pickled garlic during aging.*J. Korean Society Food Nutri.* 23: 805-810.

Kumar KP, Sampath DB, Chiranjib B, Tiwari PA: A traditional medical herb and its health benefits (2010). *J. Chemical and Pharmaceutical Res*. 2(1): 283-291

Macrae R, Robinson RK, Salder MJ (1993).Encyclopedia of Food Science Food Technology and Nutrition, Academic Press, SandiegoSanfransisco.Second Printing. 3: 925-941, 1528-1533.

Mc GRAW HILLS (1984).Encyclopedia of Science and Technology.4th Edition.91-92.

McNamara D (1985). Nutritional and Health Benefit of Egg Produced by FNA for AECL

Mensink RP, Zock PL, Kester ADM, Katan MB (2003). Effects of dietary fatty acids and carbohydrates on the ratio of serum total to HDL cholesterol and on serum lipids and apolipoproteins: a meta-analysis of 60 controlled trials. *American J. Clinical Nutri*.77: 1146.

Ngoddy PO, Ihekoronye IA (1985).Integrated Science and Technology for the Tropics, 2nd Edition, Macmillan Publishers Ltd. 62.

Oguntoyinbo SI, Okewande OW, Nupo SS, Sobowale SS, Ajayi JO, Odunmbaku LA, Oguntoyinbo YG (2015). Moisture adsorption of sprouted bambara groundnut flour (*Vigna subterranean*). *African Journal of Food Science and Technology*.6(6).144-148.

reference to the bacterial flora of public health importance in Nigeria. *African J. Exp. Microbial* (1): 13-19.

Reuter HD (1995).*Allium sativum and Allium ursinum*. *Pharmacology and Medicinal Application.Phytomedicine*. 2(1): 73-91.

Warchafsky S (1993).Effect of garlic on total serum cholesterol annals of internal med. *American Botanical Council*.119: 599-605.