

## EFFECT OF FRESH RAW QUAIL EGGS ON THE LIPID PROFILE AND BLOOD SUGAR LEVEL OF DIABETES-INDUCED ALBINO RATS - A REVIEW

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### ABSTRACT

A review was carried out to ascertain the effect of fresh raw quail eggs on the lipid profile and blood sugar level of diabetes-induced albino rats. Data were gathered from Google Scholar, Research Gate and Google. A total of 34 articles were selected for evaluation out of 154, which were retrieved and subjected to careful and critical review. All the articles reviewed, indicated a common treatment group (Diabetes induced rats treated with fresh raw quail eggs) and two controls (positive and negative). The positive control involved diabetes induced albino rats not treated with fresh raw quail eggs, the negative control on the other hand involved normal albino rats untreated with fresh quail eggs. Seventy-five percent (75%) of the articles reviewed reported a reduction ( $p < 0.05$ ) in the total cholesterol levels (TC) when the diabetic albino rats were treated with fresh raw quail eggs as compared to the positive control. Eighty-five percent (85%) of the authors had a reduction ( $p < 0.05$ ) in the high density lipoprotein levels (HDL) for treatment group compared to their positive control counterparts, when they treated the diabetic albino rats with quail eggs. All the articles reviewed reported a decrease ( $p < 0.05$ ) in the Low density lipoprotein (LDL) among diabetic albino rats treated with fresh raw quail eggs as compared to their positive control counterparts. Seven-five percent (75%) of the articles reported a reduction ( $p < 0.05$ ) in the total triglyceride level (TG) among the diabetic albino rats treated with fresh raw quail eggs as compared to their control counterparts. It was further noticed that, all the articles reviewed, noted a decrease ( $p < 0.05$ ) in the blood glucose level when they treated the diabetic albino rats with fresh raw quail eggs. From the foregoing, it can be established that quail eggs was responsible for the various reductions seen above and so it can be concluded that quail eggs is a potential remedy for Diabetes mellitus.

### INTRODUCTION

#### Background of the study

Eating habits of humans has led to so many health complications such as hypertension, obesity, diabetes, cancer and many more. According to World Health Organization (2019), unsafe food contains harmful microbes such as bacteria, viruses, parasites or chemical substances which has led to more than 200 diseases and/or disorders ranging from diarrhoea, cholera, obesity, diabetes, kidney failure, cancers, etc. The current

statistics with regards to eating habits indicates that, as high as 600 million, almost 1 out of 10 people in the world fall sick after consuming unsafe food and 42,000 die per year (WHO, 2019).

Recently, research has found out that quail eggs are highly nutritious. Considering the nutritional value of quail eggs, Tunsaringkarn *et al*, (2013) realized in his their study that the nutritional values of quail eggs are higher than those offered

by other eggs, for example about 3-4 times greater than chicken eggs and also a rich source of antioxidants and vitamins. It also contains substantial amount of minerals like copper, fluorine, sulphur, silicon, zinc, and stimulates the hematopoietic function of bone marrow (Tunsaringkarn *et al.*, 2013). Vitamins, in quail eggs, play significant role in metabolic activities including tryptophan metabolism, formation of active tetrahydrofolate, formation of ferritin as cellular antioxidant, iron absorption, electron transport system, catecholamine synthesis, omega-oxidation of fatty acids and coenzyme for cathepsin and liver esterase (Eteng *et al.*, 2006).

Quail eggs have been widely acclaimed as having a lot of therapeutic potentials (Howard *et al.*, 2006). Regular consumption of quail eggs has been shown to fight against several diseases (Truffier, 1978). In Japan, consumption of Japanese quail eggs has been claimed to improve metabolism, prevent stress, and help in the treatment of obesity, asthma and various allergies (Truffier, 1978).

The effect of quail egg is perhaps connected to its nutritional contents such as omega-3 fatty acids, omega-6 fatty acids, selenium, choline, magnesium, potassium, iron, folic acid, zinc, phosphorus, vitamins, etc. (Howard *et al.*, 2006); it also contains substantial amount of minerals like copper, fluorine, sulphur, silicon, zinc etc (Tunsaringkarn *et al.*, 2013).

With all these claims about quail eggs and the increasing search for natural remedies to diseases especially *Diabetes mellitus*, this study reviewed articles on the effect of fresh raw quail eggs on the blood sugar and lipid profile of diabetes-induced albino rats to ascertain the potency of quail eggs as a remedy for *Diabetes mellitus*.

#### Specific objectives

- i) Review the effect of fresh raw quail eggs on lipid profile of diabetes induced albino rats.
- ii) Review the effect of fresh raw quail eggs on the sugar level of diabetes induced albino rats.

#### MATERIALS AND METHODS

##### Sampling of articles

Data used for this review were sourced from

Google Scholar, Research Gate, and Google. The articles gathered were related to the effect of quail eggs on albino rats.

#### REVIEW

##### Lipid profile of albino rat

The constituents of lipid are cholesterol and triglyceride, but cholesterol is hydrophobic and therefore is usually carried by lipoproteins (Ononogbu, 1988; Oslon, 1998; Nelson and Cox, 2000). Lipoproteins can either be high density (HDL) or low density (LDL) (Oslon, 1998; Christie, 2003; Brunzell *et al.*, 2008), the high density lipoprotein carries cholesterol to the liver to be excreted and so higher levels of this HDL do not really pose a health threat (Brunzell *et al.*, 2008). Low density lipoprotein on the other hand may be harmful if they are present at higher levels (Brunzell *et al.*, 2008). So for a lipid profile to be normal, these constituents of the lipid profile must individually be normal. Normal range of albino rat's blood serum high density lipoprotein is 50.00-56.67mg/dl, triglyceride (TG) is 47.57-108.11mg/dl, total cholesterol (TC) is 86.19-144.76mg/dl and low density lipoprotein is 11.24-77.46mg/dl (Brunzell *et al.*, 2008).

##### Effect of quail eggs on cholesterol level of Diabetic Albino Rats

All the articles reviewed noted that they induced the diabetes in albino rats using Alloxan, indicating that the rats were hyperglycemic because most of their insulin producing cells would have been destroyed by the Alloxan (Lenzen, 2008)

Three out of four articles reviewed identified a decrease ( $p < 0.05$ ) in the total cholesterol level in the serum of the diabetes induced albino rat treated with quail eggs as compared to the positive control (Table 1). The remaining one article observed, realized an increase ( $p < 0.05$ ) in the total cholesterol levels in the blood serum of the diabetic rats treated with quail eggs as compared to the positive control. This is a total contradiction to the findings of the majority of the authors, they had concluded that since the levels of cholesterol in the blood serum of the induced Albino rats were not lowered after the treatment, quail eggs lacks the ability to remedy cholesterol issues. Notwithstanding, if the majority is to be considered, it can be concluded that consump-

**Table 1: Total Cholesterol (mg/dl) in the blood serum of diabetic rats treated with raw quail eggs**

Treatments			References
Normal rats/ Untreated (C <sup>-</sup> )	Diabetic rats/ Untreated (C <sup>+</sup> )	Diabetic rats/ treated with quail eggs	
122mg/dl	142mg/dl	98mg/dl	Patrick and Jonas (2015)
48mg/dl	55mg/dl	45mg/dl	Oladipo and Ibukun (2017)
51mg/dl	56mg/dl	75.5mg/dl	Lontchi-Yimagou <i>et al.</i> (2016)
108.5mg/dl	135mg/dl	89mg/dl	Umera <i>et al.</i> (2018)

C<sup>+</sup> = Positive control C<sup>-</sup> = Negative control

tion of quail egg was responsible for the reduction of the total cholesterol level of the blood serum of the diabetic albino rats. Nevertheless, none of the authors mentioned what in the egg was responsible for this reduction, though some of the authors did certain analysis on the quail eggs. Oladipo and Ibukun (2017), noted that the pool of fatty acids, amino acids, and other bioactive compounds present in the yolk and albumen of quail eggs were anticholesterolemic i.e. can lower the cholesterol level.

#### Effect of quail eggs on high density lipoprotein (HDL) levels of Diabetic Albino Rats

Two out of the three articles reviewed, recorded an increase ( $p < 0.05$ ) in high density lipoprotein (HDL) levels in the blood serum of diabetes induced albino rats treated with raw quail egg as compared to their positive control counterparts (Table 2), Patrick and Jonas (2015) attributed the increase in HDL they observed in their experiment to the presents of zinc in quail eggs which has antioxidative properties. Experimental evidences indicate that antioxidants are important in treating diabetes (Matough *et al.*,

2012). According to Omoruyi *et al.* (2001), any substance with antidiabetic potential must be able to increase the levels of HDL and lower LDL levels. Notwithstanding, one article had contradictory finding: Umera *et al.* (2018) rather recorded a decrease ( $p < 0.05$ ) in the blood serum (HDL) among the diabetic albino rats treated with quail eggs as compared to the positive control (Table 2).

Though the levels recorded by all the authors for HDL were within the recommended normal level (50.00-56.67mg/dl) (Brunzell *et al.*, 2008), the fact still remains that since majority (66.7%) of the authors recorded an increase in the high density lipoprotein among the diabetic albino rat treated with quail eggs, quail eggs could be responsible for this increase. Though (HDL) is good for the body, since it carries cholesterol from tissues to the liver to be excreted, excess of it could also be dangerous to the body. According to Danchin *et al.* (2018), a higher amount of HDL in the blood serum beyond the recommended normal threshold is harmful to the body.

**Table 2: Total high density lipoprotein (mg/dl) in the blood serum of diabetes rats treated with raw quail eggs**

Treatments			References
Normal rats/ Untreated (C <sup>-</sup> )	Diabetic rats/ Untreated (C <sup>+</sup> )	Diabetic rats/ treated with quail eggs	
56.33mg/dl	52.66mg/dl	60.33mg/dl	Patrick and Jonas (2015)
31mg/dl	16mg/dl	33mg/dl	Oladipo and Ibukun (2017)
37.75mg/dl	59.00mg/dl	44.25mg/dl	Umera <i>et al.</i> (2018)

C<sup>+</sup> = Positive control C<sup>-</sup> = Negative control

**Effect of quail eggs on low density lipoprotein (LDL) level of Diabetic Albino Rats**

All the articles reviewed recorded a decrease ( $p < 0.05$ ) in the low density lipoprotein (LDL) in the blood serum of the diabetes induced albino rats treated with quail eggs as compared to the positive control (Table 3). Umera *et al.*, (2018) deduced that the ability of quail egg to reduce the elevated LDL could be due to the anti-stress properties of the egg or their anti-dyslipidemic activities ie ability to reduce the amount of abnormal lipid in the blood. They went ahead to conclude that the significant ( $p < 0.05$ ) reduction of the LDL levels, could enhance the HDL: LDL ratio and by implication could attenuate diseases associated with total cholesterol and LDL. Oladipo and Ibukun (2017) in their report, also attributed the significant reduction in the LDL to the anti-stress properties of the egg or their anti-dyslipidemic activities. Low density lipoprotein also known as “bad cholesterol” is dangerous to the body since it carries cholesterol from the excretion site (the liver) to the tissues of the

body and so prevent excess cholesterol from being excreted. So these reductions in the LDL and increasing HDL levels realized by these authors could mean that the remedy for the reduction of cholesterol in the body is quail eggs. Nevertheless, nothing has been said about the particular active agent in the eggs that was responsible for this reduction, so how these reductions happen is unknown. It seems, there is no scientific justification to the use of quail eggs as a remedy to the reduction of LDL and to the larger extent, cholesterol.

**Effect of quail eggs on total triglyceride levels of Diabetic Albino Rats**

All the articles reviewed with exception of one, realized a decrease ( $p < 0.05$ ) in the total triglyceride levels in the blood serum of diabetes induced albino rats when they were treated with quail egg (Table 4). Umera *et al.* (2018) concluded that quail eggs did not have any negative effect on the lipid profile (cholesterol and triglyceride levels) profile of diabetic rats but rather

**Table 3: Total low density lipoprotein (mg/dl) in the blood serum of diabetes rats treated with raw quail eggs**

Treatments			
Normal rats/ Untreated (C <sup>-</sup> )	Diabetic rats/ Untreated (C <sup>+</sup> )	Diabetic rats/ treated with quail eggs	References
45.06mg/dl	66.67mg/dl	21.92mg/dl	Emeka and Anayo (2015)
4mg/dl	29mg/dl	11mg/dl	Ibukun and Oladipo (2016)
38mg/dl	59.75mg/dl	27.75mg/dl	Umera <i>et al.</i> (2018)

C<sup>+</sup> = Positive control    C<sup>-</sup> = Negative control

**Table 4: Total Triglyceride (mg/dl) in the blood serum of diabetes rats treated with raw quail eggs**

Treatments			
Normal rats/ Untreated (C <sup>-</sup> )	Diabetic rats/ Untreated (C <sup>+</sup> )	Diabetic rats/ treated with quail eggs	References
103mg/dl	114mg/dl	78.66mg/dl	Emeka and Anayo (2015)
15.5mg/dl	56mg/dl	12mg/dl	Oladipo and Ibukun (2017)
61mg/dl	63mg/dl	103mg/dl	Lontchi-Yimagou <i>et al.</i> (2016)
61mg/dl	81.25mg/dl	58.50mg/dl	Umera <i>et al.</i> , (2018)

C<sup>+</sup> = Positive control    C<sup>-</sup> = Negative control

has the ability to lower the lipid, thereby reducing the risk of diabetic dyslipidemia. Lontchi-Yimagou *et al.* (2016) recorded a rise in the total triglyceride levels in the blood serum of the diabetic albino rat when treated with quail eggs. They argued that the triglyceride content of quail eggs is the same as that of the chicken, and so the rise in the triglyceride levels in the blood serum of the diabetic rat when they were treated with quail eggs wasn't surprising.

#### Effect of quail eggs on blood glucose levels of Diabetic Albino Rats

All the articles reviewed noticed a decrease ( $p < 0.05$ ) in the blood glucose levels when they treated the diabetes induced albino rats with quail eggs (Table 5), indicating that quail eggs were responsible for the reduction in the glucose levels. Aba and Onah (2016) attributed the reduction recorded in their study to the presence of nutrients such as amino acids (leucine, valine and alanine), minerals such as zinc and vitamins such as vitamin E in the eggs. This could be possible because according to Van Loon (2012), leucine as an amino acid has the ability to lower blood glucose levels. Umera *et al.* (2018) realized that quail eggs have a hypoglycemic effect in the long term, because when they treated their rats with quail egg they realized a decrease as the days went by, with day 21 being the last day recording the greatest reduction in the blood glucose levels. They attributed the hypoglycemic effect of quail eggs to the presence of minerals and amino acids which play key roles in blood glucose homeostasis by regulating the key enzymes (glucokinase, pyruvate kinase) involved in glucose metabolism.

#### CONCLUSION

After the evaluation of the various articles, it was established that majority of the authors realized a decrease in the cholesterol and triglyceride (lipid profile) levels of the blood serum of the diabetes induced rats when they were treated with quail eggs. They also recorded a decrease in the blood glucose levels when they treated the diabetes induced rats with quail eggs and so it can clearly be concluded that quail eggs possess antidiabetic properties. But there is no known scientific justification as to how this hypoglycemic and hypolipidemic effects of quail egg is achieved. However, some authors attributed it to the nutrients in the eggs yet nothing has been said about how these nutrients carried out this hypoglycemic and hypolipidemic effects.

#### RECOMMENDATION

It is recommended that more research should be done in this subject area, so that more articles can be reviewed to bring about a better comprehension. Also research should be carried out on how the hypoglycemic and hypolipidemic abilities of quail eggs is achieved, so that scientific justification of quail egg's hypoglycemic and hypolipidemic abilities can be established.

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**Table 5: Effect of quail eggs on the blood glucose level (mg/dl) of diabetic rats treated with raw quail eggs**

Treatments			References
Normal rats/ Untreated (C <sup>-</sup> )	Diabetic rats/ Untreated (C <sup>+</sup> )	Diabetic rats/ treated with quail eggs	
98mg/dl	340mg/dl	320mg/dl	Lontchi-Yimagou <i>et al.</i> , (2016)
83.80mg/dl	347.20mg/dl	109.60mg/dl	Aba and Onah (2016)
163.5mg/dl	400.3mg/dl	70.50mg/dl	Agbafor <i>et al.</i> (2017)
114mg/dl	417mg/dl	124mg/dl	Umera <i>et al.</i> (2018)

C<sup>+</sup> = Positive control C<sup>-</sup> = Negative control

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