



# ***Oryctes owariensis* Larvae As Vitamin Supplements For Man And Livestock**

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## **ABSTRACT**

Samples of fresh and processed *Oryctes owariensis* larvae were identified, gathered from the wild here in Bayelsa State and taken to the food technology laboratory of University of Port Harcourt in Rivers State for both qualitative and quantitative analysis employing procedures by AOAC, (2000). The results obtained proved that both fat soluble vitamins (A, D, E, K) and water soluble vitamins (B complex: B1, B3, B12 and C) were found present in varying amounts. Values obtained from vitamin B1: 1.7mg/100g and 1.2mg/100g; vitamin B12: 2.6mg/100g and 1.4mg/100g; vitamin D: 4.2mg/100g and 2.8mg/100g; vitamin E: 19.9mg/100g and 12.2mg/100g and vitamin K: 1.0mg/100g and 0.4mg/100g respectively for fresh and dried larvae were in conformity with the Recommended Daily Allowance as reported by World health Organization. The quantities of vitamin A: 1.7mg/100g and 0.1mg/100g; vitamin B3: 3.2mg/100g and 1.8mg/100g and vitamin C: 8.5mg/100g and 5.3mg/100g respectively for fresh and dried larvae were below the recommended daily allowance, though can serve as food supplements. Therefore, the inclusion of *O. owariensis* larvae in human diet can provide sustainable and cost effective solution to meeting vitamins requirement especially in areas where malnutrition and malnourishment due vitamin deficiencies are prevalent, making the larvae, promising and sustainable food source.

**Key words:** *Oryctes owariensis*; Qualitative; Quantitative; Malnutrition; Vitamins; Supplement

## **1. INTRODUCTION**

*Oryctes owariensis* Beavois, is a scarabeid specie of Rhinoceros beetle of the family Dynastinae and Order Coleoptera (Ukoroije and Bawo, 2019). It is considered a food insect and generally accepted as special delicacy in Nigeria, particularly in the South South and South Western parts of the country. According to Ukoroije and Bobmanuel, (2019), the larvae are processed and sold in the open markets along streets where they are consumed alone or along with wine, soft, beer or used in preparation of jellof rice, stew and others.

*O. owariensis* larvae have been proven to have good concentration of nutrients in all classes of food such as carbohydrates, proteins, fats/oil and minerals (Akinola *et al.*, 2013). The larvae have been recommended as fit for food supplements of both humans and livestock, meeting the Recommended Daily Allowances (RDA) for various classes of food by World Health Organization (Ukoroije and Bobmanuel, 2019). Vitamins are essential in human nutrition, playing major roles in various metabolic processes while sustaining all round health. Though various aspects of macro and micro nutrients with

regards to *O owariensis* larvae have been studied, there is no established literature on the vitamin profile, thus, necessitating the reason for the study.

Vitamins are organic compound found in trace levels in foods that are naturally occurring. Vitamin deficiencies may make some health problems more likely to occur (Brazier, 2023). Water-soluble and fat-soluble vitamins are the two main categories of vitamins. Since fat-soluble vitamins are kept in reserve in the body for months, they are found in fatty tissues and the liver. During digestion, they are taken up from dietary fibers through the colon and include vitamins A, D, E, and K (Brazier, 2023). Water-soluble vitamins pass out of the body through urination and do not accumulate in the body. Thus, are needed more than fat soluble vitamin. They include vitamins B complex and C.

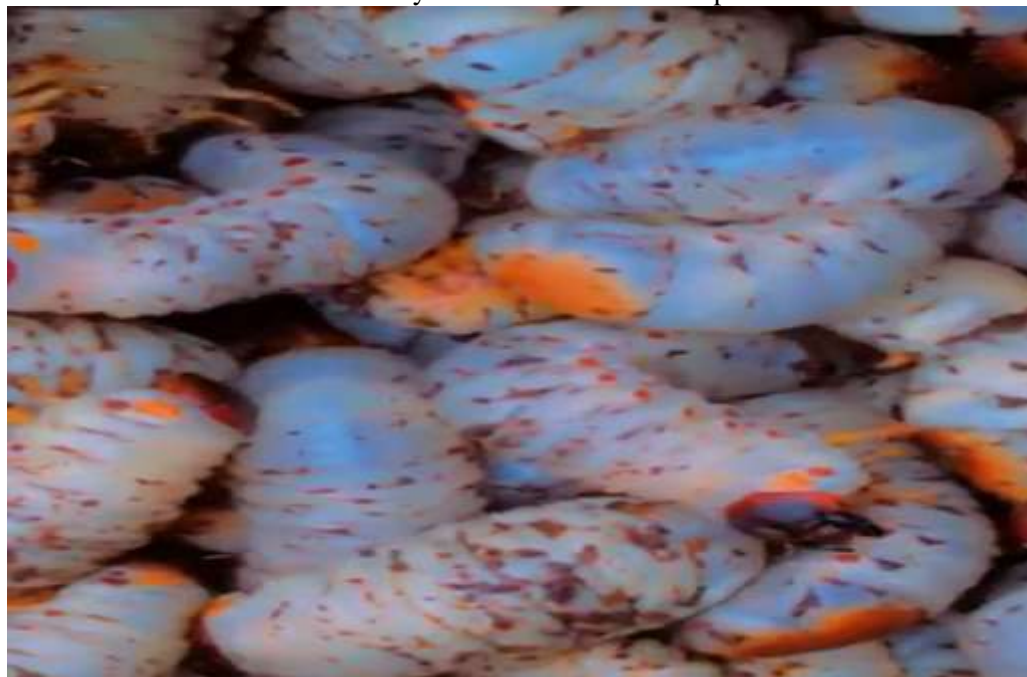


Plate 1: *O. owariensis* larvae, Source: Authors

## 2. MATERIALS AND METHODS

A total of 400 third instar larvae of the beetle were used for the bio assay. Adopting the methodology of AOAC (2000), qualitative analysis of vitamins present in both fresh and processed larvae was investigated.

Employing the methods of Benitez (2000); Womeni *et al.*, (2012); Sami *et al.*, (2014), the amount of vitamins present in both fresh and processed larvae was determined quantitatively. Processed *O. owariensis* larvae was dried at 50 °C for 48 hours and digested using porcelain mortar to obtain the crude semi-solid form.

### Analysis of water soluble vitamins content

With a few minor adjustments, a colorimetric test was used to evaluate the vitamin C level. Five grams of dried *O. owariensis* sample were weighed and placed to a fifty millilitre tube along with twenty milliliters of distilled water. Following a centrifugation of the homogenate, 5 ml of the resulting liquid was extracted and added to 5 ml of a solution that contained iodine at 5.10<sup>-3</sup> N. A few drips of starch were added to the mixture after mixing. Sodium thiosulfate was used to titrate starch at 5.10<sup>-3</sup> N to equivalency.

The quantity of Vitamin C present was calculated thus,  $M = (C12V12 - \frac{1}{2} CthVE)M$ . Where; M: The amount of vitamin C in five milliliters of solvent; Iodine level (C12); diode volume (V12) introduced to the mixture; VE: The amount of sodium thiosulfate added; Cth: The sodium thiosulfate content used; M: Ascorbic acid's molecular size.

**Vitamin Bcomplex.**

In a nutshell, 50 ml of H<sub>2</sub>SO<sub>4</sub> (0.1 N) was used to extract 2g of the larval sample, which was then incubated for 30 minutes at 121°C. After allowing the liquid to cool, 2.5M sodium acetate was added to bring the pH down to 4.5. After being kept at 35°C for the entire night, the resultant mixture was filtered through Whatman No. 4 filter paper. After collecting the filtrate into a clean tube, it was diluted with 50 milliliters of distil water and filtered again through a 0.45 µm micropore filter. A Zorbax SB C8 (3.5µm, 4.6 × 750 mm) column from the Agilent 1100 series (Agilent, U.S.A.) was filled with 20 µl of the filtrate. At a flow rate of 1 ml/min, a mobile phase comprising 10 mM sodium salt of methanol:hexane sulphonate and 1 ml orthophosphoric acid in a 20:80% ratio was employed. UV detection was recorded at 265 nm. The B vitamins were measured by comparing them to solutions of conventional B vitamins (Sami et al., 2014).

**Analysis of fat-soluble vitamins**

Vitamins A, D, E, and K were added using the Sami et al. (2014) approach for both fresh and dried (processed) grubs. With the Agilent 1100 series (Agilent, U.S.A.) for quantitative analysis of the vitamins, UV detection was recorded at 325 nm for vitamin A, 265 nm for vitamin D, 290 nm for vitamin E, and 244 nm for vitamin K.

**Statistical Analyses**

Results were represented as averages of three replicates calculated using mean and standard deviation. Results derived quantitatively were subjected to one way ANOVA to determined significant differences in number of vitamins present and at what level of significance.

**3. RESULTS AND DISCUSSION**

Table 1: Qualitative analysis of vitamins present in both fresh and dried *O. owariensis* larvae

S/NO	Vitamin	Name
1	A	Retinol
2	B1	Thiamine
3	B3	Niacin
4	B12	Cobalamine
5	C	Ascorbic acid
6	D	Calciferol
7	E	Tocopherol
8	K	Phylloquinone

Source: Authors, 2024.

The following vitamins were qualitatively determined present in *O. owariensis* larvae Vitamins A, B complex, C, D, E and K.

Table 2: Quantitative analysis of vitamins present in fresh and dried *O. owariensis* larvae

<i>O. owariensis</i> sample	Reps	A (mg/100g)	B <sub>1</sub> (mg/100g)	B <sub>3</sub> (mg/100g)	B <sub>12</sub> (mg/100g)	C (mg/100g)	D (mg/100g)	E (mg/100g)	K (mg/100g)
<b>Fresh</b>	1	2.45a	3.67a	3.48a	2.81a	8.71a	4.03a	18.56b	0.58a
	2	1.46a	3.48a	3.01a	2.43a	7.34a	4.08a	20.48b	1.69a
	3	1.32a	3.02a	3.00a	2.61a	9.48a	4.36a	20.53b	0.77a
	MN±S.D	1.7±0.6a	3.4±0.3a	3.2±0.3a	2.6±1.2a	8.5±1.2a	4.2±0.2a	19.9±1.3b	1.0±0.6a
Dried	1	1.41a	2.36a	1.56a	1.45a	5.65a	2.84a	10.41b	0.05a
	2	1.02a	1.04a	1.08a	1.61a	4.88a	2.92a	10.56b	0.63a
	3	1.30a	2.51a	2.76a	1.08a	5.51a	2.52a	15.51b	0.56a
	MN±S.D	1.2±0.2a	2.0±0.8a	1.8±0.9a	1.4±0.3a	5.3±0.4a	2.8±0.2a	12.2±2.9b	0.4±0.3a

Source: Authors, 2024

Table 2 shows vitamins present in fresh and processed *O. owariensis* larvae in varying quantities. Results are gotten from experimentations of three replicates and expressed in mean values at mg/100g. The same letters on row show significant difference at  $p < 0.05$ .

Vitamins are essential in human activities playing important roles in various metabolic processes while sustaining all round health. The above study revealed the presence of both vitamins B complex and C (water soluble). It also revealed vitamins A, D, E and K (fat soluble) in appreciable amounts. This is in agreement with result obtained by Onyeike *et al.*, (2015).

Vitamin A (Retinol and Beta carotene) is essential for vision, immune function, growth of cells, development and differentiation. Deficiency is night blindness, vulnerability to infections and impaired growth and development (Clifford and Kozil, 2017). Recommended daily allowance for men is 90mg/100g and women 70mg/100g. Values obtained from the study are 1.7mg/100g and 1.2mg/100g for fresh and dried larvae. Thus, larvae can be eaten as supplementary meal.

*Oryctes owariensis* grubs contain vitamin B complex (B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub> and B<sub>12</sub>). Thiamin (Vitamin B<sub>1</sub>) is essential for energy metabolism and maintenance of healthy nervous system. Deficiency is beriberi symptomized as muscle weakness, nerve damage and cardiovascular issues, Wernicke-korsakoff syndrome (Brazier, 2023). Recommended daily allowance for men is 1.2mg/100g and women 1.1mg/100g. Result of the study indicated that both fresh and dried *O. owariensis* larvae had 3.4mg/100g and 1.2 mg/100g which are in accordance with the recommended daily allowance for humans.

Vitamin B<sub>3</sub> (Niacin) is involved in energy metabolism and promoting healthy skin, nerves and digestion. Deficiency is pellagra symptoms as skin rashes, digestive problems and neurological symptoms (Fact sheet, 2020). Recommended daily allowance for me is 16mg/100g and that of women 14mg/100g.

Vitamin B<sub>12</sub> is essential for preventing anaemia and maintains neurologic health. It prevents dementia and heart disease (Felman, 2023). It boosts energy levels. Neurological damage due to vitamin B<sub>12</sub> deficiency include nerve damage, spinal cord damage, confusion, changes in gait and other movements, numbness and tingling of hands and feet. Others are mental health problems such as reduction in academic performance in learners, irritability, memory loss, depression and dementia. Recommended daily allowance for adult is 2.4mg/100g and that of pregnant women 2.6mg/100g. 2.6mg/100g and 1.4mg/100g are values obtained from the analyses of fresh and processed larvae. These values are in accordance with the recommended daily allowance for B<sub>12</sub> intake by humans.

Vitamin C (Ascorbic acid) is an oxidant that supports immune function, collagen synthesis and iron absorption. It also enhances wound healing thus supporting healthy bones, skin and connective tissues.

Deficiency breeds scurvy symptomized by fatigue, weak immune system and bleeding gums, poor tissue growth and loss of teeth. The recommended daily allowance for men is 90mg/100g while that of women is 75mg/100g. Analysis of study gave 3.2mg/100g and 1.8mg/100g for fresh and dried larvae, which can be incorporated into real meals.

Vitamin D (Calciferol) functions in the absorption of calcium and phosphorus for healthy bones and teeth. It prevents osteomyelitis in adults and rickette in children. Deficiency leads to bone formation, risk of fracture and compromised immune function. The recommended daily allowance is 1.5-2.0mg/100g. From the study, analysis revealed the presence of Vitamin D as 4.2 mg/100g and 2.8mg/100g respectively for both fresh and processed larvae. This also aligned to the recommended daily allowance for the said vitamin and is in conformity with the result reported by Akinola *et al.*, (2013).

Tocopherol also known as Vitamin E is known to be a oxidant that protects cells from damage due free radicals. Also supports immune function and healthy skin maintenance. Deficiency leads to weakness of muscle, vision impairment and low immune responses. Others include haemolytic anaemia in new born which destroys blood cells (Reddy and Jialal, 2020). Recommended daily allowance is 15mg/100g. Vitamin E had 19.9mg/100g and 12.2mg/100g respectively for fresh and processed larvae. These values are also in agreement with the daily allowance recommended for vitamin E intake.

Vitamin K (Phylloquinone) functions in blood clotting and bone health. It also ensures effective clotting of blood thus preventing excessive blood loss. Deficiency leads to impaired clotting resulting to uncontrolled bleeding and death or bleeding diathesis (Reddy and Jialal, 2020). Recommended daily allowance is 1.2mg/100g. Value obtained from the research showed that fresh larvae had a value of 1.0mg/100g which also is in agreement with the recommended daily allowance for vitamin K by humans.

The variations in vitamin level are attributed to source, season and processing methods in addition to diet and habitat type which are basic environmental factors that affect the vitamin composition of food insects. The availability and composition of food source such as plant material, decaying organic matter, roots and stems affect greatly the grub vitamin uptake as different species contain different amounts of vitamins, thus grub diet diversity does affect the vitamin profile according to Nyah *et al.*, (2020). Van Huis *et al.* (2013) state that while edible insects are generally considered to be a great supplier of vitamins, the specific species will determine how many vitamins they contain.

Chavunduka *et al.*, (2019), stated that seasonal variations such a rainfall, temperature and humidity also affect nutrient content of edible insects. Furthermore, Payne *et al.*, (2016), reported that postharvest handling and processing techniques also affected the vitamin composition of grubs. They further maintained that high temperature cooking also leads to degradation of vitamin.

#### 4. CONCLUSION

Vitamins are essential in human nutrition, playing major roles in various metabolic processes while maintaining all round health. The vitamins found in processed *O. owariensis* larvae are similar in value and even higher than those found in foods like chicken, beef and eggs, indicating that food insects are viable and sustainable alternatives to nutritional requirements for man and livestock.

#### DECLARATION OF CONFLICT OF PURPOSE

The writers affirm that they have no competing interests.

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