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The Proximate Composition of Edible Insects: Which Way Forward?

E.N. Amadi*

Department of Microbiology, Rivers State University of Science & Technology, Nkpolu-Oroworukwo, Port Harcourt, Rivers State, Nigeria
**Corresponding author*

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A B S T R A C T

Nutritional composition of two edible insects, *Rhynchophorus phoenicis* and *Brachytrupes membranaceus* from five different workers were compared. Disparity as high as ca.54 percentage points was observed for *B. membranaceus* and 56% for *R. phoenicis*. The disparity observed cannot be attributed to whether or not wet or dry weight was applied. No two workers used exactly the same method as there were subtle differences. The source of these variations may actually be inherent in the methods. A standard method is advocated for the proximate composition of edible insects.

Introduction

Proximate composition, a common terminology in Food Science refers to the six (6) components of moisture, crude protein, ether extract, crude fibre, crude ash and nitrogen-free extract (carbohydrate). Moisture, crude protein, ether extract, crude fibre and ash are usually obtained through chemical reactions in experiments while carbohydrate is based on the determination of the other five using the difference method of Raghuramulu, *et al.*, (1983). Proximate compositions should always add up to 100% as any deviation from 100% displays the resolution of the chemical test (Anon, 2017). It is not uncommon to see small variations in the way each test is performed by chemists or Food scientists. These variations accumulate, may overlap and affect the final result. Furthermore, proximate composition is determined either on dry weight or wet weight basis; either way, it is expected that the results obtained should be comparable/similar within the limits of experimentation.

Proximate composition has been used extensively in the determination of the nutritional value of edible insects (Quin, 1964; Dreyer and Wehmeyer, 1982; Ohiokpehai *et al.*, 1996; Bukkens, 1997; Wachukwu *et al.*, 2002; Amadi *et al.*, 2005; Ekpo and Onigbinde, 2005; Agbidye *et al.*, 2009; Cerda *et al.*, 2010; Adeyeye and Awokunmi 2010; Alamu *et al.*, 2013; Amadi *et al.*, 2014; Chakravorty *et al.*, 2014; Amadi and Kiin-Kabari, 2016; Amadi, *et.al.*, 2016a, 2016b). Amadi and Kiin-Kabari (2016)

reviewed the nutritional composition and microbiology of some edible insects commonly eaten in Africa found disparity between the values obtained for the same insects by different workers and advocated the use of a comprehensive, standardised and universally acceptable method so that values obtained can be scientifically compared. Amadi, *et al*., (2016a) also called for a method that would lend itself to comparison and produce comparable and reliable data.

Source of Data

The data analysed here were taken from the works of Amadi, *et.al*. (2016b), Agbidye, *et al*., (2009), Adeyeye and Awokunmi (2010), Adeyeye and Awokunmi (2010), Ekpo and Onigbinde, 2005. All the workers claimed to use the standard method for proximate composition, i.e. AOAC (2012), although with subtle differences.

Results and Discussion

The data from the workers listed above are presented in tables 1 and 2. Table 1 shows the results obtained for *Rhynchophorus phoenicis* while table 2 represents that on *Brachytrupes membranaceus*. There is massive variation in the dry and wet weight values obtained for *R. phoenicis* by the same workers. Also variations abound between the values obtained by the different workers, the least being for carbohydrate. Comparing the values for *B. membranaceus* by Agbidye, *et al*., (2009) with those of Amadi, *et al*., (2016b) shows that the latter had lower values except for moisture; differing between 1 and 35 percentage points while moisture differed by 43 percentage points. When the data by Adeyeye and Awokunmi (2010) are compared with that of Amadi, *et al*., (2016b), the latter had higher values for moisture and fat while the former are higher in protein, carbohydrate and ash; varying between 5 and 50 percentage points. The data for the same insect by Adeyeye and Awokunmi (2010) are lower in moisture, protein and fat when compared with those of Agbidye, *et al*., (2009). Adeyeye and Awokunmi (2010) values are higher in carbohydrate and ash; the differences falling between 2 and 49 percentage points. It is worthwhile to note that the values for both workers were derived from dry weight! The data in tables 1 and 2 do not add up to 100%. The proximate composition values from the work of Wachukwu, *et al*., (2002) are particularly striking as only three parameters add up to 114.40%.

Table.1 Comparison of the proximate composition of *Rhynchophorus phoenicis* larva and adult weevil by various workers

Parameter	Ekpo & Onigbinde (2005)		Wachukwu, *et.al*. (2002)	Difference			Amadi, *et.al*., (2014) Adult beetle		Difference
	DW (A)	WW (B)	Not Specified (C)	A-B	A-C	B-C	With chitin (WW)D	Without chitin (WW)E	D-E
Moisture	-	61.85	ND	-61.85	NC	NC	56.82	52.88	3.94
Fat	66.61	25.30	81.60	41.31	-14.99	-56.30	4.17	9.15	-4.98
Protein	22.06	8.38	30.30	13.68	-8.24	-21.92	32.71	26.85	5.86
Carbohydrate	5.53	2.10	2.50	3.43	3.30	-0.40	0.88	1.69	-0.81
Ash	5.79	2.20	ND	3.59	NC	NC	0.98	0.58	0.40
Fibre	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL	99.99	99.83	114.40				104.15	97.55	

NC = No comparison
ND = Not determined
DW = Dry weight
WW = Wet weight

Table.2 Comparison of the proximate composition of *Brachytrupes membranaceus* obtained by various workers

Parameter	Agbidye, *et. al*. (2009)	Adedeye and Awokunmi (2010)	Amadi, *et. al*. (2016a)	Difference		
	Dry Weight (A)	Dry Weight (B)	Wet Weight (C)	A-B	A-C	B-C
Moisture	11.60	0.90	54.49	10.70	-42.89	-53.59
Fat	53.05	4.20	18.10	48.85	34.95	-13.90
Protein	35.06	29.10	20.22	5.96	14.84	8.88
Carbohydrate	2.33	51.90	1.22	-49.57	1.11	49.68
Ash	3.25	5.70	0.97	-2.45	2.28	4.73
Fibre	6.30	8.20	5.0	-1.90	1.30	3.20
TOTAL	111.59	100	100			

It would seem, therefore, that the disparity observed cannot be attributed to whether or not wet or dry weight was applied. No two workers used exactly the same method as there were subtle differences. The source of these variations may actually be inherent in the methods. A standard method is advocated for the proximate composition of edible insects.

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