

Morphology and bait preference of Black rat (*Rattus rattus*) in University community in Nigeria: Obafemi Awolowo University as case study

Abstract

Aims: This study assessed the morphology and the bait preference of black rat (*Rattus rattus*) in Obafemi Awolowo University student hostel with the aim of controlling the population of black rat in the students' hostels.

Place and Duration of the Study: The study was carried out at Obafemi Awolowo University which is situated in Ile-Ife, an ancient city in the Southwestern Nigeria and lies between latitudes 7°28'N and 7.467°N and longitudes 4°34'E and 4.567°E with a landmass of 5,506 hectares between December 2017 and February 2018

Methodology: Locally made metal traps (cage traps) (Plate 1) contains baits were placed fortnightly in various sampling locations (Awolowo, Fajuyi, Angola, Akintola, Mozambique and Moremi halls of residence) for a period of 3 months between the months of December, 2017 to February, 2018. The traps were set around the dark corners of the sites in the evening and collected the following morning between **21.00- 6.00 hour.**

Results: A total of 236 black **rat** (*Rattus rattus*) were caught (81 male & 155 female), with the female having the highest weight (238.30 g). Among the baits used, fried fish caught the highest number of black **rat** (58%) followed by beans cake (akara) (28%) and the locust bean (14%). There **is** positive correlation in the morphology of the black **rate** caught in all the hostels.

Conclusion: The black rats in the University student hall of residence **are** of the same family and genus, and fried fish is the best preferred bait.

Keywords: *Rodents, Morphology, Baits, PCA, Measurement*

Introduction

The black rat is one of the most widespread animal species in the world due to their adaptability to a wide range of habitats (1). *Rattus rattus* is able to utilize most terrestrial habitat types on continents and islands. In urban areas, they are found around warehouses, residential buildings, and other human settlements. Roof rat (*R. rattus*), house rat (*Mus musculus*) and Norway rat (*R. norvegicus*) play a significant role within public health sector (2) such as carriers of many infectious and parasitic diseases that can be transmitted to human being (3).

37 In urban areas, the damage caused by rodent incisor activity cannot be underestimated, most especially to
38 power cable leading to blackout and fire in most cases (4). At home and hostels, black rat (*R. rattus*)
39 caused damage to clothes, foods, books, household materials that are stored and sometimes in use. At
40 home, the tips of fingers and toes are biting by black rat if they are not properly washed before going to be
41 (5). If not control, rodent pests are connected to considerable economic losses and become a considerable
42 conservation threat to life, indigenous flora and fauna in most part of the world (2).

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44 In various hostel and staff quarters in the Obafemi Awolowo Universities, black rat (*R. rattus*) has been the
45 major rodent causing damage to both students and staff properties. The population of black rat kept
46 increasing due to availability of shelter, food and water (6). The University community has defined many
47 means of controlling black rat (*R. rattus*), but to no avail.

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49 In line of the damage cause by rodent (Black rat), continuous control of rodent population are important
50 especially in human populated area (Hostel) where risks to health and security are greater due to the
51 presence of rats pests (2). Alteration of environment can produce substantial changes in vertebrate
52 population, since they depends upon the environment for shelters, food and water (7).

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54 Morphometric analysis is a tool used in extracting information about biological material and biological
55 processes. It is defined as the quantitative characterization, analysis, and comparison of biological forms
56 (Roth and Mercer, 2000). According to Linzey (9), the black rat is a medium sized, slender brownish-or
57 grayish-black rat with a coarse fur, grayish-white under part, large eyes and ears, and whiskers around
58 the nose which is pointed. They possess a tail that is sparsely scaly and longer (approximately 110
59 percent) than the combined length of the head and body. The total length is about 32.5-42.5 cm long, tail
60 length about 19-24 cm long, hind foot length 3.5-3.8 cm long and weight is about 140-280g. .

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62 Black rats (*R. rattus*) is an omnivore but a selective feeder and eat a wide range of foods including seeds,
63 fruits, stems, leaves, fungi and a variety of invertebrates and vertebrates (10). They are not specific in their
64 preference for food, they have been observed to feed on anything ranging from stored food to cooked
65 food, to plastic, wood and many other food sources. They are therefore called generalists (11). However,
66 human being often provides rodents with an abundance of food, water, shelter and favourable
67 microclimatic condition, which allow them to be comfortable and multiply easily (12). The number of rats
68 that are able to exist in any given location depends on availability of foods, water and harbourage (13).

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70 These factors are commonly found among students in University where both shelter and food are being
71 provided for black rat (*R. rattus*). Since rodents populations has being attributed to risk of health in high
72 densities of human inhabitants (such as University hostels), it is important to look for way to control them
73 without endangering them. Hence, this study is aimed at assessing the morphological variation of black
74 rats (*Rattus rattus*) found in some locations on Obafemi Awolowo University Campus; and determine the

75 most effective bait that can be used to capture black rats to prescribe to University authority the best bait to
76 use in controlling black rat in the University community.

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78 **2.1 Materials and Methods**

79 **2.1.1 Description of study area**

80 The study was carried out at Obafemi Awolowo University which is situated in Ile-Ife, an ancient city in the
81 Southwestern Nigeria and lies between latitudes 7°28'N and 7.467°N and longitudes 4°34'E and
82 4.567°E with a landmass of 5,506 hectares and altitude of 300m above sea level (Encyclopedia
83 Britannica, 2014).

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85 The climate of the area is humid tropical with distinct dry and wet seasons. The wet season starts from
86 around mid-March to late October and the rainfall pattern is bi-modal with peak periods in July and
87 September. The dry season runs from November to March but a short spell usually occurs in August. The
88 mean annual rainfall is about 1400mm. The mean ambient temperature ranges from 20 °C to 30 °C with a
89 mean temperature of 26 °C.

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91 **2.2 Sampling sites**

92 The location of the survey includes three male hall of residence and three female hall of residence on
93 Obafemi Awolowo University Campus. These sites were chosen in order to note and record the food
94 consumed and mostly preferred by the black rats in the halls of residence. Three traps were used for one
95 week interchangeably to ensure random sampling of the captured rats. The trapping activities were
96 carried out during the months of December, 2017 to February, 2018. The various hall of residence
97 includes;

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99 **2.2.1. Awolowo hall**

100 This is a male hall and is known to be the most populated hall in Obafemi Awolowo University with a
101 maximum capacity of 2,032 legal occupants (students). Trees and bushes of varying sizes are found
102 around this hall of residence. It consists of 8 blocks of 42 rooms each, and annex of 8 blocks with 10
103 rooms each.

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105 **2.2.2. Fajuyi hall**

106 This is a male hostel and the known 2nd most populated hall in Obafemi Awolowo University with a
107 maximum capacity of 1,788 legal occupants (Students). It is very close to a female hostel known as the
108 Akintola hall. It consists of 5 main blocks with 60 rooms each and annex of 10 blocks with 10 rooms each.

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112 **2.2.3. Angola hall**

113 This is a male hall which is really close to Awolowo hall and really distant from academic environment. It
114 has a maximum capacity of 1,320 legal occupants (Students). The hall consists of 11 blocks with 10
115 rooms each.

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117 **2.2.4. Moremi hall**

118 This is the female hall of residence. It has a maximum capacity of 1,228 legal occupants. The hall is
119 divided into two parts altogether containing 8 blocks with 30 or 33 rooms each.

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122 **2.2.5. Ladoke Akintola hall**

123 This is the female hostel which is very close to Fajuyi hall of residence. It has a maximum capacity of 640
124 students. This hall of residence consists of 4 blocks with 30 rooms each.

125 **2.2.6. Mozambique Hall**

126 This is a female hall located adjacently to Angola hall. It has a maximum capacity of 1,722 legal
127 occupants (students). It consists of 14 blocks with 10 rooms each and 2 annex at the lower part of the
128 hall. There are a lot of small grasses and bushes around it.

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130 **2.3. Materials**

131 Materials used for rats' collection include the following:

- 132 1. Locally made metal traps (cage traps) for trapping one rat at a time (Plate 1).
- 133 2. Latex Examination glove to prevent one from direct contact with them.
- 134 3. Rubber gloves to protect against rat bite.
- 135 4. Baits which include locust beans (*Iru*), beans cake (*Akara*) and fried fish.

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137 In the laboratory, the materials used were:

- 138 1. Killing jar with chloroform to anaesthetize the specimen.
- 139 2. A top loading weighing balance (Salter, model 250, England made) and an electronic weighing
140 scale to measure the weights of collected samples.
- 141 3. A measuring board to measure the morphometric data.
- 142 4. Thick Hand gloves to prevent contamination with germs while working in the laboratory.
- 143 5. Thread for easy measurement.

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147 **2.3.1. Sampling method**

148 Locally made metal traps (cage traps) (Plate 1) contains baits which are the locust beans, beans cake
149 and fried fish hooked to an iron rod attached to it in order to attract the rats were placed fortnightly in
150 various sampling locations (Awolowo, Fajuyi, Angola, Akintola, Mozambique and Moremi halls of
151 residence) for a period of 3 months between the months of December, 2017 to February, 2018. The traps
152 were set around the dark corners of the sites in the evening and collected the following morning between
153 21.00- 6.00 hour. The trapped black rats (*R. rattus*) were taken to the laboratory for measurement and
154 further analysis.

155 **2.3.2. Data collection**

156 The captured rats were anaesthetized in a close jar containing chloroform, tagged, and weighed on a
157 scout weighing balance (Plate 2) and placed on the measuring board (Plate 3) for morphometric
158 determination. The tag carried the specimen number along with other information which included place of
159 collection, date of capture and sex of the rat which was determined by checking the scrotal sacs (only
160 males have scrotal sacs) were documented.



170 **Plate 1:** A trap set at one of the study site

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Plate 2: Black rat on a Scout™ Pro weighing scale (Top loading)

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Plate 3: Black rat on a measuring board to measure the morphometric parameters

198 The morphometric parameters such as the Body length (BL), Tail length (TL), Ear length (EL), Sex, Hind-

199 foot length (HL) and the Body weight (BW) were recorded. The body length was taken by measuring from

200 the tip of the mouth to the tip where the tail attaches to the body. The tail length is measured from where

201 the tail attaches to the body. The ear length is measured from the tip where the ear attaches itself to the
202 head to the longest end of the ear. The hind length is measured from its point of attachment to the leg to
203 the tip of the longest toe.

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205 **3.0 Results**

206 A total of **sixty-nine** (236) black rats belonging to the family Muridae, order Rodentia were caught from the
207 various sampled halls of residence (Table 1). Of the total **catch**, 23.31 % (55) of it was recorded in
208 Moremi hall which was the highest while the lowest percentage of the catch were recorded in Awolowo
209 Hall with 12.71 % (30). **The highest number (20) of male black rat (*R. rattus*) were caught in Moremi Hall,**
210 **while the least number (10) were caught in both Angola and Akintola respectively. The highest number**
211 **(35) of female black rat (*R. rattus*) were caught in both Moremi and Mozambique Hall, while the least**
212 **number of female black rat (21) were caught in Akintoal Hall. Irrespective of the sampling point, higher**
213 **percentage (65.68%) of female black rats were collected during the period of study when compared with**
214 **male (34.32%).**

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216 The morphometric parameter of the female black rat specimens is shown in Table 2. **In the table**, the
217 statistical analyses revealed that the mean Hind-foot length (HL) and Ear length (EL) of the female black
218 rats collected from Mozambique and Angola were statistically different ($p \leq 0.05$) from that of the female
219 black rat specimens collected from other halls of residence.

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221 The Hind-foot length of the female black rats collected from halls of residence on OAU Campus **which**
222 **ranged from 2.10 cm (Mozambique and Fajuyi) to 4.70 cm (Moremi) had** the highest mean Hind-foot
223 length value of 3.64 ± 0.18 cm recorded in the female black rats specimen collected from Moremi hall.
224 This was closely followed by the specimens collected from Awolowo hall with a length value of 3.62 ± 0.16
225 cm while the lowest mean Hind-foot length was recorded in the female black rats specimen collected from
226 Mozambique hall with a value of 2.70 ± 0.60 cm (Table 2)

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239 **Table 1:** The abundance of black rats (*Rattus rattus*) caught in various halls residence on
240 Obafemi Awolowo University, Ile-Ife

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S/N	Halls of residence	Catch Frequency		Total caught	Percent (%)
		Male	Female		
1	Akintola	10	21	31	13.14
2	Moremi	20	35	55	23.31
3	Mozambique	18	35	53	22.45
4	Awolowo	11	19	30	12.71
5	Angola	10	22	32	13.56
6	Fajuyi	12	23	35	14.83
7	Total	81	155	236	100

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250 **Table 2:** The morphometrics parameters of female Black rats (*Rattus rattus*) caught in various halls of residence on

S/N	Halls of residence	Statistics	Hind-foot Length (cm)	Ear Length (cm)	Body Length (cm)	Tail Length (cm)	Body Weight (g)
1	Akintola	Range	2.20-4.00	2.00- 3.50	11.20 - 23.50	12.80 - 26.70	55.90 - 207.30
		Mean	3.51 ^a	2.86 ^a	18.64 ^a	21.67 ^a	146.51 ^a
		±S.E	±1.61	±0.12	±1.18	±1.54	±5.30
2	Moremi	Range	2.90 - 4.70	2.40 - 3.40	13.90 - 25.30	15.70 - 27.40	85.50 - 238.30
		Mean	3.64 ^a	2.89 ^a	18.91 ^a	21.99 ^a	145.53 ^a
		±S.E	±0.18	±0.09	±1.09	±1.17	±17.25
3	Mozambique	Range	2.10 - 3.30	1.70 - 3.00	8.30 - 21.90	9.20 - 23.00	12.50 - 153.80
		Mean	2.70 ^b	2.35 ^b	15.10 ^b	16.10 ^{ab}	83.15 ^{ab}
		±S.E	±0.60	±0.65	±6.80	±6.90	±7.65
4	Awolowo	Range	3.00 - 3.90	2.30 - 3.20	15.10 - 20.30	21.80 - 23.00	125.60 - 143.80
		Mean	3.62 ^a	2.82 ^a	18.26 ^a	22.52 ^a	134.80 ^a
		±S.E	±0.16	±0.15	±0.91	±0.22	±3.30
5	Angola	Range	2.30 - 3.50	1.90 - 3.00	9.60 - 19.50	11.50 - 21.80	25.30 - 126.30
		Mean	2.80 ^b	2.38 ^b	14.16 ^b	16.18 ^{ab}	70.34 ^{ab}
		±S.E	±0.24	±0.22	±1.85	±2.14	±7.81
6	Fajuyi	Range	2.10 - 3.80	1.80 - 3.20	10.20 - 20.80	11.10 - 25.20	18.90 - 178.30
		Mean	3.04 ^{ab}	2.58 ^{ab}	15.28 ^b	17.14 ^b	92.67 ^{ab}
		±S.E	±0.35	±0.31	±2.26	±2.73	±3.80

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 252 *Means within column with different Superscript are significantly different ($P \leq 0.05$) from each other. What is meant by a, b, ab

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257 The Ear length (EL) of the female black rat specimens which ranged between 1.70 cm (Mozambique) and
258 3.50 cm (Akintola) was reported to have highest mean Ear length value of 2.89 ± 0.09 cm (Moremi) and a
259 lowest mean Ear length value of 2.35 ± 0.65 cm (Mozambique). The statistical analyses however revealed
260 a significant difference ($P \leq 0.05$) in the Ear length of the female black rat specimens collected from various
261 hall of residence (Table 2).

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263 The female black rat specimens collected from Moremi hall had the highest range (13.90 cm - 25.30 cm)
264 of the Body length (BL) and the highest mean Body length (18.91 ± 1.09 cm). The lowest mean Body
265 length of the female black rat specimens was however recorded in the sample collected from Angola hall
266 (14.16 ± 1.85 cm). The mean Body length of the black rats specimen collected from Akintola (18.64 ± 1.18
267 cm), Moremi (18.91 ± 1.09 cm) and Awolowo (18.26 ± 0.91 cm) which were not statistically different from
268 each other ($P \geq 0.05$) were however different statistically ($P \geq 0.05$) when compared with Body length of the
269 female black rat specimens collected from other halls of residence (Table 2).

270
271 The Tail length of the female black rat specimens ranged between 9.20 cm (Mozambique) and 26.70 cm
272 (Akintola). The highest mean Tail length of the female black rat specimens was however recorded in the
273 specimens collected from Awolowo hall with a value of 22.52 ± 0.22 cm, followed closely by 21.99 ± 1.17
274 cm in specimens from Akintola hall. The lowest mean Tail length 16.10 ± 6.90 cm in the female black rat
275 specimens was recorded in the specimens collected from Mozambique hall. Statistical variation ($P \leq 0.05$)
276 was however recorded in the Tail length of the female black rats collected from various halls of residence
277 (Table 2).

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279 The Body weight (BW) of the female black rat specimens which ranged between 12.50 cm (Mozambique)
280 and 238.30 cm (Moremi) had the highest mean value of 146.51 ± 5.30 cm (Akintola) and least mean
281 value of 70.34 ± 7.81 cm (Angola) which was however statistically different ($P \leq 0.05$) from all the recorded
282 mean Body weight value (Table 2).

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284 The morphometric parameter of the collected male black rats in halls of residence on Obafemi Awolowo
285 University is shown in Table 3. As shown in the table, Hind-foot length, Ear length, Body length,

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Table 3: The morphometric parameters of male Black rats (*Rattus rattus*) caught in various halls of residence on Obafemi Awolowo University, Ile-Ife

S/N	Halls of residence	Statistics	Hind Length (cm)	Ear Length (cm)	Body Length (cm)	Tail Length (cm)	Body Weight (g)
1	Akintola	Range	1.70 - 3.80	2.20 - 3.20	10.50 - 25.00	11.50 - 25.60	19.30 - 187.50
		Mean	3.30 ^{ab}	2.81 ^a	18.68 ^a	20.18 ^a	116.13 ^{ab}
		±S.E	±0.21	±0.11	±1.39	±1.49	±5.55
2	Moremi	Range	3.30 - 4.70	2.60 - 3.40	17.20 - 24.30	22.00 - 26.70	106.70 - 226.50
		Mean	3.94 ^b	2.98 ^a	21.14 ^a	23.82 ^a	160.46 ^b
		±S.E	±0.26	±0.14	±1.32	±0.88	±3.77
3	Mozambique	Range	2.50 - 3.50	2.10 - 2.80	11.70 - 18.90	13.80 - 20.20	57.70 - 114.30
		Mean	3.03 ^{ab}	2.53 ^a	15.77 ^a	17.93 ^a	83.17 ^a
		±S.E	±0.29	±0.22	±2.13	±2.07	±6.58
4	Awolowo	Range	2.90 - 3.90	1.50 - 3.60	9.80 - 20.50	9.00 - 23.80	17.70 - 152.30
		Mean	3.57 ^{ab}	2.93 ^a	17.07 ^a	19.98 ^a	109.3 ^{ab}
		±S.E	±0.18	±0.34	±1.54	±2.24	±9.39
5	Angola	Range	2.00 - 3.40	1.18 - 2.90	11.20 - 18.70	11.90 - 23.40	23.20 - 145.80
		Mean	2.70 ^a	2.35 ^a	14.95 ^a	17.65 ^a	84.50 ^a
		±S.E	±0.70	±0.55	±3.75	±5.75	±6.1
6	Fajuyi	Range	2.80 - 4.20	2.30 - 3.80	15.70 - 24.30	18.10 - 28.40	65.70 - 200.70
		Mean	3.59 ^{ab}	3.09 ^a	20.13 ^a	23.76 ^a	150.61 ^{ab}
		±S.E	±0.19	±0.20	±1.09	±1.34	±8.96

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*Means within column with different Superscript are significantly different ($P \leq 0.05$) from each other. What is meant by a, b, ab

301 Tail length and Body weight ranged from 1.70 cm (Akintola) - 4.70 cm (Moremi); 1.18 cm (Angola) - 3.50
302 cm (Fajuyi); 9.80 cm (Awolowo)- 25.00 cm (Akintola); 11.50 cm (Akintola) - 28.40 cm (Fajuyi); and
303 17.70 cm (Awolowo) - 226.50 cm (Moremi) respectively.

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305 The highest mean hind-foot length value (3.94 ± 0.26 cm) of the male black rats caught was recorded in
306 Moremi hall while the lowest hind-foot length value (2.70 ± 0.70 cm) of the male black rat specimens was
307 recorded in Angola hall. The statistical analyses of the hind-foot length values for the male black rat
308 specimens collected from Moremi and Angola hall showed a statistical difference ($P \leq 0.05$).

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310 Similar to the values recorded in the hind-foot length of the male black rats collected from various halls of
311 residence, highest ear length (2.98 ± 0.14 cm), mean body length (21.14 ± 1.32 cm) and mean tail length
312 (23.82 ± 0.88 cm) was recorded in the male black rats specimens collected from Moremi hall while the
313 least value of these parameters 2.35 ± 0.55 cm; 14.95 ± 3.75 cm and 17.65 ± 5.75 cm respectively were
314 recorded in the specimens caught in Angola hall. Statistical analyses showed that there were no
315 significant differences ($P \geq 0.05$) in all the values recorded for these parameters (Table 3).

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317 Male black rat specimens collected from Moremi hall had the highest mean body weight value of 160
318 ± 3.77 cm which was closely followed by the specimens caught in Fajuyi hall with a value of 150 ± 8.96 cm.
319 The lowest mean body weight value (83.17 ± 6.58 cm) of the male black rat specimen was recorded in
320 Mozambique hall. Comparative analyses however showed that the mean body weight of the male
321 specimens collected from Moremi was significantly different ($P \leq 0.05$) from the mean body weight of the
322 rats specimens collected from Mozambique 83.17 ± 6.58 cm and Angola 84.50 ± 6.10 cm which were not
323 statistically different ($P \geq 0.05$) from each other (Table 3).

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325 Morphometric parameters subjected to a Principal Component Analysis (PCA) showed correlations and
326 variance occurred among the six (6) Halls of Residence where the black rat specimens were captured.
327 The Principal Component divided the Black Rats into five (5) Components namely the PC (1, 2, 3, 4, and
328 5) representing (BW, TL, BL, EL and HL) respectively which have an Eigen value each and percentage
329 variance in Table 4a. From this table only PC1 (BW) of Eigen value 3040.6 and percentage variance of
330 99.69 had the most significant being higher than the Joliffe cut- off of 4.27.

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332 Also, in Table 4b, it is observed that PCI (BW) had the highest Eigen value of 4.29646 and percentage
333 correlation of 85.929 compared to all other parameters. Here in correlation the Joliffe cut-off is 0.7. The
334 loading plot in Table 4b showed clearly the variance that occurred.

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Table 4a: The Eigen value and percentage variance of each Principal Component of Black rats captured from all Halls of Residence under the Joliffe cut-off of 4.27

PC	Eigen Value	% variance
1	3040.6	99.69
2	6.69493	0.2195
3	2.56926	0.084237
4	0.142177	0.0046615
5	0.0397171	0.0013022

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Table 4b: The Eigen value and Percentage Correlation of each Principal Component of Black rats captured from all the Halls of Residence with a Joliffe cut-off of 0.7

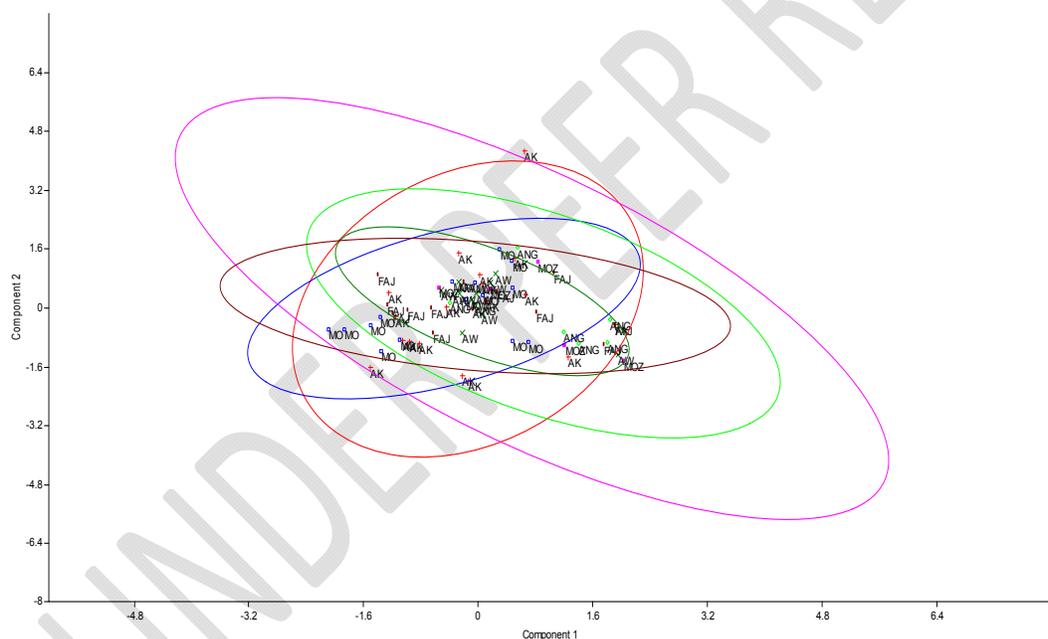
PC	Eigen value	% Correlation
1	4.29646	85.929
2	0.309825	6.1965
3	0.177207	3.5441
4	0.129337	2.5867
5	0.0871757	1.7435

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 370 A scatter plot diagram in Figure 1 showed a cluster eclipse of all the halls of residence (Akintola, Moremi,
 371 Mozambique, Awolowo, Angola and Fajuyi) represented with different color such as (Red, Blue, Purple,
 372 Deep green, Green and Indigo) respectively. The plotting showed that all the black rats in the six different
 373 Hall of Residence belong to the same homogeneous population, though there might be a very little
 374 variation which is statistically insignificant.

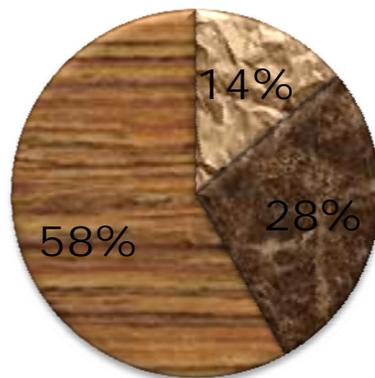
375
 376 The black rats preference for the bait used in this study is shown in Figure 2. In the figure, preference for
 377 bait showed that most of the catches were from the trap baited with fried fish (58%), followed by beans
 378 cake (28%). The trap baited with locust beans recorded the least number of catch (14%). Figure 3A
 379 showed that the frequency of male caught by bait in halls of residence had traps with fried fish with a total
 380 of 41, followed by beans cake which caught 27 and locust beans which caught 13. Figure 3B also showed
 381 that 95 female rats were caught by fried fish, followed by Beans cake which caught a total of 40 and
 382 locust beans with a total of 20.



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 384 **Figure 1:** Principal Component Analysis (PCA) Scatter Plot showing Morphometric
 385 relationship in Black rats captured from all the six (6) halls of residence.

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395 ■ Locust Bean ■ Bean cake ■ Fried fish

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Figure 2: Effects of bait preference on percentage of Black rats caught in all the halls of residence based on food-bait preference.

UNDER PEER REVIEW

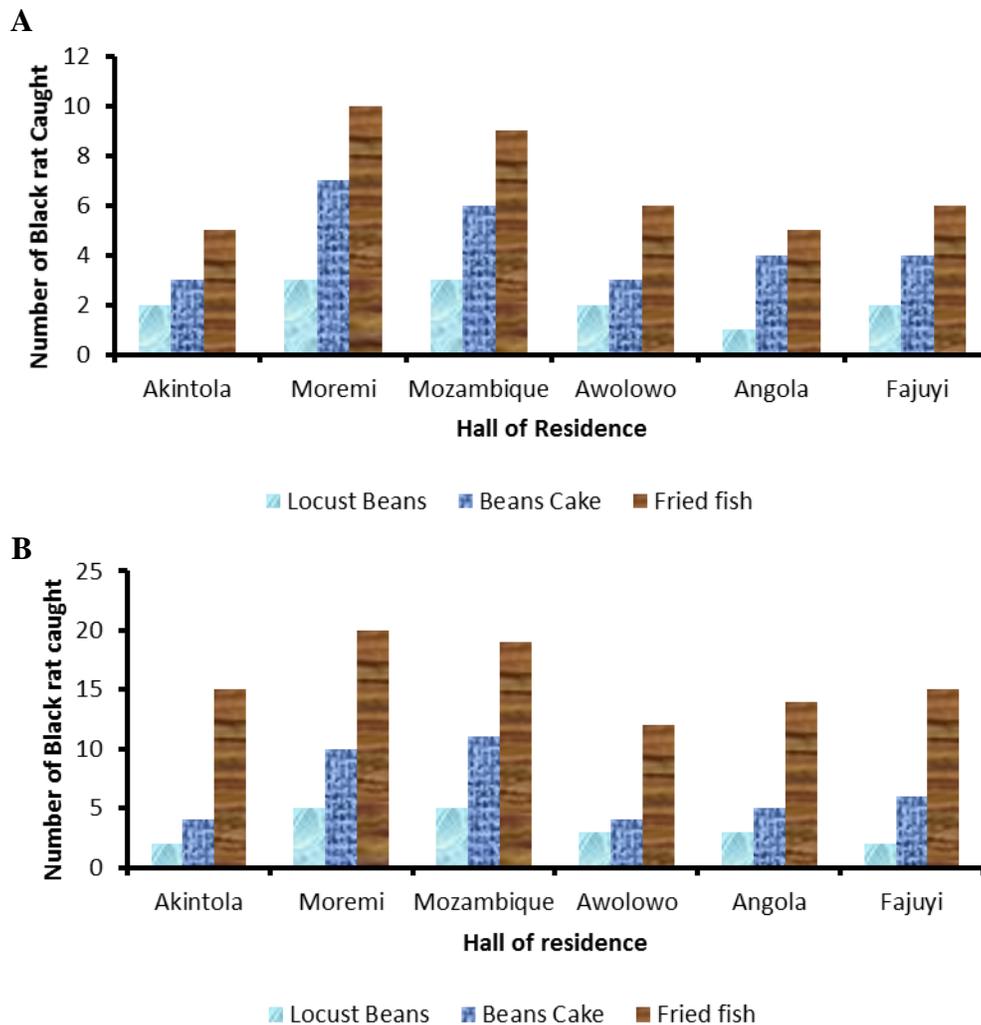


Figure 3: Effects of different baits on the quantity of Black Rat (*Rattus rattus*) caught in different students' residence in the University. (A) Male Black rat, (B) Female Black rat

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401 4.0 Discussion

402 The abundance and composition of black rats collected in various hall of residence, Obafemi Awolowo
 403 University, Ile-Ife corroborates the findings and submission of several authors that black rats are
 404 cosmopolitan (14;15). However, the sex ratio in this study was not equilibrated (81 males to 155 females)
 405 and was differ from the findings of Ben Faleh *et al.*, (16). The reduction in the number of male black rat
 406 may be due to competition and their territorial behavior (17).

407

408 The various variation exhibited by the black rats in the measured morphometric have been reported to be
 409 hypothetically due to climatic factors, metabolism rate, competition and mating success (18 and 19).
 410 However, size variation is generally considered more liable to environmental gradients than shape (19).

411

412 Generally, a very strong positive correlation (0.97) exhibited among the determined parameters in this
413 study corroborates the findings of morphometric characters of Albino rats by Aguha *et al* (20) which
414 showed **that** there were satisfactory correlations between the body length and their respective
415 parameters.

416
417 However, there were indications that the body length and tail length may have better link with the body
418 weight than the rest of the parameters (20). This study also showed that there was an increase in
419 variation between body weight and body length when their values increased, this **meant that** some black
420 **rat** might have higher body weight but a smaller body length.

421
422 Virtually, in this study it can be deduced **that** all the parameters when compared with the body weight had
423 a very positive correlation coefficient except in ear length which is apparently low compared to others.
424 This was also similar to what was reported by Jimmy *et al.* (21) who determined the variability in body
425 morphometric measurements and relationship between body weight and other morphometric
426 measurements in Albino rats (*Rattus norvegicus*). **Where correlation between Body weight and Ear length**
427 **was low and other parameters had high significant (P < 0.001) positive correlation.**

428
429 Black **rat** (*Rattus rattus*) **possesses** the ability to select favourable food, which even displays their
430 potential for local difference in the choice of food (6). One food is eaten among other alternatives, based
431 on factors such as taste; nutritional value and texture (22). This could be one of the reasons why the **rat**
432 specimens opt for the food used as bait in this study.

433 The preference for fried fish used as bait in this study by the black rats could be due to its flavour. Fishes
434 are known to be flavoured food with high nutritional value (23). Myers (24) reported **that** rats preferred
435 food with high flavour. Also Brooke's and Lavoie (25), Sarwar *et al.* (26) confirmed in their research **that**
436 additives like sugar and vegetable oils at 1% to 3% concentration increases the food intakes of black rats
437 and makes it acceptable and palatable to them. In this study it was observed **that** both fried fish and
438 beans cake (akara) had the highest rate of acceptability and preference amidst the black rats because
439 they both contain additive like oil.

440

441 **Conclusion**

442 The morphology of the black **rat** (*R. rattus*) from the residence in the university **are** similar which means
443 they are of the same family and genus. Fried fish out of three baits (Fried fish, beans cake & locust bean)
444 used for the study proof efficient in catching black **rat** in **students all of residence**. Although, it may be
445 expensive to use, since it is the fried fish flavour that attract the black **rat**, fried fish flavour however can
446 be used with other food material in catching black **rat**.

447

448

449 Competing Interests

450 Authors have declared that no competing interests exist

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