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Relationships among Body Traits of African Giant Land Snail (Achachatina Marginata) at Different Age Groups

By Samuel Oladipo Kolawole Fajemilehin, Maria Kikelomo Adegun, Fagbuaro & Sola Sunday

Ekiti state University, Nigeria

Abstract- The experiment designed to investigate the various body parameters of African Giant Land Snail and their relationships was carried out at the Teaching and Research Farm, Ekiti state University, Ado – Ekiti between 21st of November 2011 and 2nd of January 2012 using a total of 182 snails of four different age groups defined as >2 years; >1year<2years; >6months < 1 year and <6months. The variables examined include whole weight, whorl number, whorl length and shell opening. Data collected were subjected to ANOVA, correlation and regression analyses using SPSS statistical package. Results showed significant ($p < 0.05$) differences between age and all the parameters investigated except whorl number in all the age groups. The correlation between age and whorl length showed that there was significant effect ($p < 0.05$) among the variables. A negative correlation between the whorl number and shell opening (-0.14) was recorded. The regression of whole weight on whorl length and shell opening were highly significant ($p<0.01$) with R2 values of 0.67 in both cases while the regression of whole weight on whorl number was significant ($p<0.05$) with R2 value of 0.19.

Conclusively, age and weight of African Giant Snail have significant effects on the body measurements..

Keywords: *shell opening, whole weight, whorl length, whorl number, correlation, regression.*

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Relationships among Body Traits of African Giant Land Snail (Achachatina Marginata) at Different Age Groups

Samuel Oladipo Kolawole Fajemilehin [α], Maria Kikelomo Adegun [σ], Fagbuaro [ρ] & Sola Sunday [ω]

Abstract- The experiment designed to investigate the various body parameters of African Giant Land Snail and their relationships was carried out at the Teaching and Research Farm, Ekiti state University, Ado – Ekiti between 21st of November 2011 and 2nd of January 2012 using a total of 182 snails of four different age groups defined as >2 years; >1year<2years; >6months < 1 year and <6months. The variables examined include whole weight, whorl number, whorl length and shell opening. Data collected were subjected to ANOVA, correlation and regression analyses using SPSS statistical package. Results showed significant ($p < 0.05$) differences between age and all the parameters investigated except whorl number in all the age groups. The correlation between age and whorl length showed that there was significant effect ($p < 0.05$) among the variables. A negative correlation between the whorl number and shell opening (-0.14) was recorded. The regression of whole weight on whorl length and shell opening were highly significant ($p<0.01$) with R2 values of 0.67 in both cases while the regression of whole weight on whorl number was significant ($p<0.05$) with R2 value of 0.19.

Conclusively, age and weight of African Giant Snail have significant effects on the body measurements.

Keywords: shell opening, whole weight, whorl length, whorl number, correlation, regression.

I. Introduction

Achachatina marginata is one of the two most popular breeds of snails in Nigeria (Okon and Ibom 2011). Hunting of Achachatina marginata defined as gathering of snails from bush around homesteads, thick forest and cash crop plantations during clearing is an age long farming activity by both children and adults living in farming and rural areas of South Western Nigeria. The need for such farming activities arose probably out of inquisitiveness and pleasure derived by snail – gatherers, ease with which they are handpicked, provision of supplemental food for the household and the need to meet/supplement the hunters' financial needs.

The initial aim of raising snails just for sustenance has changed. Snail farming is now an enterprising business in most parts of the world. This is probably because snails have numerous advantages over the conventional domesticated animal species. These advantages include; management ease; requirement for small rearing space; source of high quality animal protein (Ajayi et al 1998; Cobbinah 1998); its high contents iron and phosphorus; low content of sodium, fat and cholesterol (Akinnusi, 2002, Ejidike, 2002); its shell usefulness as calcium salt in animal formulated feeds, making ornaments, ashtrays, scouring powder and ceramic materials (Awesu 1980); its therapeutic values and the usefulness of the shell and the facial droppings as valuables in fertilizer production.

To ensure the sustainability of this enterprise, the productive capability of the animal must be improved optimally. Okon and Ibom (2011) asserted that genetic improvement of animal species can be achieved by quantitative measurements, correlation among performance traits and development of selection programme for effective planning. They opined that regression and correlation are the two most common techniques used to determine the relationships between and/or among two or more variables. This study is therefore designed to carry out a quantitative measure of the animal's morphometric traits and to determine the interrelationships among the traits using correlation and regression techniques.

II. Materials and Methods

a) Location and Housing

The experiment was carried out at the Teaching and Research Farm, Ekiti state University, Ado – Ekiti between 21st of November 2011 and 2nd of January 2012. The snails were reared in 3 movable cages with each cage measuring 180 x 120 cm in length and breadth respectively. Each cage was partitioned into six compartments and raised by 25 cm off ground with their legs placed in plastic bowls containing used engine oil to protect invasion by soldier ants and other insects. The cages were sheltered with wire mesh and mosquito nets with hinges and padlocks for each compartment. The floor of each of the compartments was covered with sack on which loamy soil was laced to a depth of 15 cm.

b) Experimental animal and Design

A total of 182 African Grant Land Snails (Archachatina marginata) of four different age groups as detailed in Table 1 below were used for the study. Each

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age group was identified with a permanent Schneider made blue marker. Snails belonging to the different age groups were randomly allocated into the cages under Completely Randomized Design. Dry plantain and banana leaves were used to cover up the snails mainly to protect them from direct sun rays. The leaves were replaced 4 times in a month before the end of the experiment.

Table 1 : Number of snails examined according to age group

Age group	Number of animals/compartment	Number of compartments	Total
>2 years	4	9	36
>1year<2years	4	9	36
>6monthsr<1year	5	10	50
<6months	5	12	60
Grand Total			182

c) Feeding

The snails in all the age groups were uniformly fed with sliced unripe pawpaw, plantain peel and pawpaw leaf. The feeding was done once daily. The leftover feed was removed daily before fresh ones were served. Adequate amount of water was supplied by wetting them regularly because the study was conducted during dry season.

d) Data collection

Data were collected on the following variables at 2 weeks interval: whole weight, whorl number, whorl length and shell opening. The whole weight was measured using Harvard air sensitive weighing balance to the nearest gram; whorl number examined by counting the numbers of whorls (rings) on the shell; whorl length measured as distance from the apex to the end of each whorl using a thread and latter placed on a tape to the nearest centimetre and the shell opening was measured in a similar way the whorl length was measured. To enhance accuracy and objectivity, the average length of all the whorls measured on each snail was taken as the whorl length of that animal and the average of the vertical and horizontal lengths of the opened region of the foot was considered as the shell opening of each experimental unit.

e) Statistical analysis

The means of each body trait were obtained for each age group. After checking the normality of data distribution and the equality of variances, the traits were treated statistically like independent variables. The values of each trait were subjected to an analysis of variance using the SPSS (1990) statistical package to evaluate the significance of sources of variation affecting measurements of each animal. Where significant differences were obtained, DMRT (Duncan, 1995) was used to verify significant differences among the means of the different age groups. Regression and Correlation analyses were done using the Correlation and Regression procedures of the same package. The regression model used was $Y = a + b x$. where : Y = Dependent variable; a = Intercept on y-axis; b = Regression coefficient and x = independent variable.

III. Results and Discussion

Table 2 showed the effects of age on all the variables measured. A look at the table revealed significant differences ($p<0.05$) in whorl length, whole weight and shell opening in all the age groups and periods examined with age Group 4 consistently showing superiority over all the other age Groups. However, the whorl number values showed that there were no significant ($p > 0.05$) differences among all the age Groups. Interestingly, the whorl numbers were constant within the same age Groups in the four periods investigated. The ranges recorded were 145 g, 2.17 cm, 0.510 cm and 1.55 cm; 142. g, 1.76 cm, 0.510 cm and 1.38 cm; 132 g, 1.75 cm, 0.510 cm and 1.34 cm; 116 g, 1.75 cm, 0.510 cm and 1.32 cm for Whole weight, Whorl length, Whorl number and Shell opening for periods 1, 2, 3 and 4 and for age groups 1, 2, 3 and 4 respectively. Succinctly, it was observed that as the snail aged in the different periods the whorl length, whole weight and shell opening increased progressively. The implication of this is that growth occurred from age group 1 – 4. It is important to note from this result, that in age groups 1 - 3, there were increases in the values recorded for whole weight, whorl length and shell opening among the different periods the data were collected but in age group 4 they were the same. This is most probably because the matured body weight of the animal had been fully attained at this age Group and so no further increment could occur in the parts investigated.

Table 2 : Effects of age on measured variables at periods 1 - 4

Periods	Variables	1	2	3	4	SEM
Period1	Whole weight (g)	178^{d}	194^{c}	291^{b}	323^{a}	0.12
	Whorl length (cm	4.32^{d}	4.75^{c}	5.66^{b}	6.49^{a}	0.14
	Whorl number (cm)	4.96	5.00	5.00	5.47	0.15
Period 2	Shell Opening (cm)	6.24^{d}	6.59^{c}	7.11^{b}	7.79^{a}	0.17
	Whole weight (g)	181^{d}	195^{c}	292^{b}	323^{a}	0.12
	Whorl length (cm	4.74^{d}	5.04^{c}	5.95^{b}	6.50^{a}	0.14
Period 3	Whorl number (cm)	4.96	5.00	5.00	5.47	0.13
	Shell Opening (cm)	6.41^{d}	6.75^{c}	7.30^{b}	7.79^{a}	0.15
	Whole weight (g)	192^{d}	201^{c}	296^{b}	323^{a}	0.12
Period 4	Whorl length (cm	4.76^{d}	5.17^{c}	6.11^{b}	6.51^{a}	0.15
	Whorl number (cm)	4.96	5.00	5.00	5.47	0.17
	Shell Opening (cm)	6.46^{d}	6.79^{c}	7.48^{b}	7.80^{a}	0.16
	Whole weight (g)	207^{d}	223^{c}	314^{b}	324^{a}	0.12
	Whorl length (cm	4.76^{d}	5.18^{c}	6.16^{b}	6.51^{a}	0.14
	Whorl number (cm)	4.96	5.00	5.00	5.47	0.16
	Shell Opening (cm)	6.48^{d}	6.80^{c}	7.50^{b}	7.80^{a}	0.15

^{abcd} means on the same row with different superscripts are significantly ($p<0.05$) different.

1 = Age group <6months; 2 = Age group > 6months < 1 year; 3 = Age group > 1year < 2years and 4 = Age group > 2 years. Period 1 = First fortnight, Period 2 = Second fortnight, Period 3 = Third fortnight and Period 4 = Fourth fortnight,

Table 3 showed the results of phenotypic correlations between morphometric traits of the snails evaluated in periods 1 and 2. The results indicated positive and high significant phenotypic correlations (r_p) between whole weight and whorl length (r=0.55) and between whole weight and shell opening (r=0.41) in the upper matrix and between whole weight and whorl length (r=0.49) in the lower matrix. Positive and significant phenotypic correlations (r_p) were recorded between whole weight and whorl number (r=0.25), between whorl length and whorl number (r=0.12) and between whorl length and shell opening (r=0.07) in the upper matrix and between whole weight and whorl opening (r=0.37), between whorl length and whorl number (r=0.16) and between whorl length and shell opening (r=.11) in the lower matrix. Negative and significant phenotypic correlations (r_p) were recorded between whorl number and shell opening (r=-0.14) in the upper matrix and between shell opening and whorl number (r=-0.12) in the lower matrix.

Table 4 showed the results of phenotypic correlations between morphometric traits of the snails studied at periods 3 and 4. The results revealed positive and significant phenotypic correlations (rp) between whole weight and whorl length (r=0.15), between whole weight and shell opening (r=0.37) and between whorl length and whorl number in the upper matrix and between whole weight and whorl length (r=0.40) and between whorl number and whorl length (r=0.19) in the lower matrix. Negative and significant phenotypic correlations (rp) was recorded between whorl number number (r=0.20), between whole weight and shell and shell opening (r=-0.15) only in the lower matrix.

Table 3 : Correlation of Whole weight and body dimensions of African Giant Land Snail (*Achachatina marginata)* for Periods 1 and 2

	Whole weight	Whorl length	Whorl number	Shell opening
Whole weight	-	0.55**	0.25*	0.41**
Whorl length	0.49**	-	0.12*	0.07*
Whorl number	0.20*	0.16*	-	-0.14*
Shell opening	0.37*	0.11*	-0.12*	-

Upper matrix = Period 1; Lower matrix = Period 2

** = ($P<0.01$) and * = ($P<0.05$)

Table 4 : Correlation of Whole weight and body dimensions of African Giant Land Snail (*Achachatina marginata)* for Periods 3 and 4

	Whole weight	Whorl length	Whorl number	Shell opening
Whole weight	-	0.15*	0.01	0.37*
Whorl length	0.40**	-	0.13*	0.01
Whorl number	0.01	0.19*	-	-0.15*
Shell opening	0.35*	0.01	-0.01	-

Upper matrix = Period 3; Lower matrix = Period 4
** = (P<0.01) and * = (P<0.05)

Correlation, a dimensionless quantity having values ranging from -1 to +1 is a measure of the intensity of association. A positive correlation means that the values of both variables rise or fall together while negative coefficient implies that an increase in one variable associates with a decrease in the other. The magnitude of the coefficient is an indication of how closely linear the variables are. In the present study, low positive relationships among the traits measured were recorded. This suggests that the traits affected are likely to be weakly under the effect of same gene action meaning that selection for an improvement of one trait will lead to a marginal positive improvement in the other traits. The proportional relationships with age reported in this study is in agreement with the work of Ojo (2011) who reported low proportional relationships with age for whorl length, whorl number, whole weight and shell opening in matured Achachatina marginata. Also, similar weak relationships have been reported by few authors in chicken (Tamer et al 2011) between live weight and head length and Sheila et al (2009) who investigated the relationships of body weight to external body abdominal girth, tibiotarsal, tarsometatarsal, wing length, and height from ground to the top of the back in adult fighting cocks. The results also corroborate the reports of earlier researchers (Okon et al. (2009) and Okon Ibom (2011) although, the values reported by these researchers were much higher than the values obtained in this study. The differences were most probably due to differences in the breed and strains and/or the age of snails studied.

The regression of weight on the whorl length, whorl number and shell opening as presented in Table 4 were highly significant (p<0.01) with R2 values of 0.67, 0.19 and 0.67 respectively. The R values measured the proportion of the total variance in the dependent variable (Y) explained by the independent variable (x). From the result it was evident from the R values that the weight of the animal can be predicted with equal accuracy from whorl length and shell opening. It can however be predicted using the whorl number but with less accuracy. This report corroborates in part the work of Olawoyin and Ogogo (2006) who reported shell length as a better predictor of body weight for growing snails.

Table 5 : Regression of Whole weight on Whorl length, Whorl number and Shell opening in matured African Giant Land Snail

Variable (X)	Y = a + bx	R^2	Sig
Whorl length	Y = -175 + 74.76x	0.67	**
Whorl number	Y = -318 + 107x	0.19	**
Shell Opening	Y = -401 + 91.01x	0.67	**

** means p<0.01

IV. Conclusion

The results obtained in this study revealed that age and weight of African Giant Snail had significant effects on the body measurements. The correlations among the variables were generally low. Also, weight of the examined snails can be predicted with reasonable accuracy from Whorl length and Shell opening.

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Acaricidal Effect of Foam Soap Containing Essential Oil of Ocimum gratissimum Leaves on Rhipicephalus lunulatus in the Western Highland of Cameroon

By Miégoué E, Tendonkeng F, Khan Payne V, Lemoufouet J, Kouam K. M, Boukila B & Pamo Tedonkeng E

University of Dschang, Cameroon

Abstract- Acaricidal effect of foam soap containing essential oil of Ocimum gratissimum leaves was tested on Rhipicephalus lunulatus in western highland of Cameroon. Five doses of essential oil (0.00; 0.04; 0.06; 0.08; 0.10µl/g) with four replications for each dose were tested in vitro. Each replication consisted of 10 ticks in Petri dish with filter paper impregnated uniformly with the foam soap on the bottom. Four of those doses (0.00; 0.06; 0.08; 0.10 µl/g) in three replications were used in vivo. In this case, each replication was made up of 10 naturally ticks infested goats. Results of this study indicated that foam soap containing essential oil of O. gratissimum leaves is toxic to R. lunulatus. The in vitro mortality rate was observed to vary from 0 to 30.00% during the treatment with the controls as compare to 80.00% with the lowest dose (0.04µl/g) on day 8 and 100.00% with the highest dose on day 6. Meanwhile, the in vivo mortality rate was observed to be 22.69% with control on day 8 after treatments whereas the highest dose killed 93.87% of the tick by this day 8. The LD50 of the foam soap containing essential oil was 0.061µl/g for in vitro and 0.066µl/g for in vivo on day 2.

Keywords: *foam soap, essential oil, ocimum gratissimum, rhipicephalus lunulatus, cameroon.*

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Keyswords: foam soap, essential oil, ocimum gratissimum, rhipicephalus lunulatus, cameroon.

I. Introduction

Breeding of ruminants constitutes one of the main productions activities in many African regions in general and in particularly in Cameroon (Pamo et al., 2002). In Cameroon, small ruminants are used as source of income and for many other purposes almost every where in the country (Pamo et al., 2001; Pamo etal., 2004). Specifically, goats for breeders are easily mobilizable investment, having a very short development cycle (Lhoste et al., 1993). Following these considerations, it appears necessary to set interested in the breeding condition of goats in this zone where the demographic and hygienic conditions are not favorable for breeding activities.

Goat breeding is slowed down by various factors including nutrition; diseases and also ticks infestation which are the most important (Pamo et al., 2005; Tendonkeng et al., 2010). This Rhipicephalus lunulatus tick has been reported to be a common ectoparasite of goats in Cameroun and the surrounding countries (Pamo et al., 2005).

In fact, ticks in general and Rhipicephalus lunulatus are one of the main causes of mortality in farm animals (IEMVT, 1989). They are also responsible for secondary infections which could be bacterial, viral or protozoa related (Soulsby, 1982). Furthermore, each of the conventional methods of tick control is quite costly and environmentally unfriendly (Pamo et al., 2005). Attention is then shifted towards natural substances with therapeutic properties like essential oils extracted from some plants. Indeed, a substantial part of plants (leaves, fruits, flowers, stems and roots) contain antiseptic, anti-inflammatory, insecticidal, bactericidal healing substances (Kuiate, 1993). The acaricidal effect of essential oils of many plants has been documented in many studies (Pamo et al., 2002; Pamo et al., 2003; Pamo et al., 2005). An important example is Ocimum gratissimum whose leaves were shown to contain essential oils which make them to be sometimes irritating and toxic (Daget & Godron, 1995; Tapondjou et al., 2002; Pamo et al., 2002). Those previous studies then bring up the problem of conditioning theses essentials oils in better way for their efficient utilization for on farm ticks control. This study is therefore aimed at finding an efficient, cheap and easily applicable method of using essential oils to fight against ectoparasites in general and ticks in particular.

II. Materials and Methods

a) Extraction of O. gratissimum essential oil

Fresh leaves of O. gratissimum were harvested and sun dried for 3days. Extraction of essential oil was done by hydrodistillation (Kuiate, 1993). Two kilograms

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of dried leaves were soaked in 6 l of water and boiled for 10h in the modified Clavenger vendor. The evaporate was collected in an open mouth bottle and filtered

The yield of essential oil was calculated using the following formula:

$$\text{yield} = \frac{\text{weight of essential oil}}{\text{weight of O. gratissimum leaves}} \text{x100}$$

b) Collection and identification of ticks

Male and female R. lunulatus ticks, frequently found on ruminants in the highlands of west Cameroon, were collected by manual removal without breaking their rostrum. These ticks were fixed in ethyl acetate and identified as R. lunulatus according to Walker et al. (2002). To have an uninfested goat population, 10 West African dwarf goats were examined and all ticks removed. Another manual removal of ticks was done 30 days later. A total of 72 ticks were collected from the 10 goats. The average weight of engorging ticks was 0.5±0.1g and the average length was 6.5±0.4 mm. These two parameters (weight and length) were used in the tests.

c) Preparation of medicated soap

Palm oil liquid soap was used as vehicle for the essential oil. A volume of 900µl of essential oil was added to 450 g of liquid soap to obtain a concentration of 2µl/g base on which all doses were prepared. The solution was poured into the molds and allowed to solidify.

d) In vitro study

R. lunilatusticks were collected from various West African Dwarf goats and identified. A disc of N°1 Whatman filter paper measuring 62.63 cm^2 surface area were soaked with soap of various concentrations of the essential oil (0.00; 0.04; 0.06; 0.08; 0.10 µl/g) and placed in clean dry Petri dishes with four replicates each at room temperature (24°C, humidity 70%). Ten ticks randomly placed in each Petri dish and covered. The plates were examine each morning during 8 days and dead ticks, if any, were counted and removed. One soap sample without essential oil served as control. The mortality rate of the tick was calculated as described by Abott (1925), and lethal dose 50 (LD_{50}) was calculated according to Valette (1972).

$$Mc = \frac{M0 - Mt}{100 - Mt} X100$$

Where: Mc is the accrued and corrected death rate, M0 the death rate in Petri dishes treated and Mt the death rate in the control Petri dish (natural mortality).

e) In vivo study on the acaricide property of essential oil

The number of R. lunulatus ticks was counted at the preferential sites (ears, tail and head) (Tenekeu, 2002) on each of the 40 goats selected in this study. Soap with four concentration of essential oil selected through an anhydrous sodium sulphate column to eliminate the trace of water present in the essential oil. The oil was stored in the dark at room temperature. after in vitro test (0.00; 0.06; 0.08; 0.10 µl/g) was applied on batches of 10 goats. The preferential sites were examined for the number of live/dead ticks every 24h for 8 days. Three replicates of 10 goats/group/dose (120 goats) were carried out during on-farm trial. Ticks removed by engorgement were not taken into consideration during analysis.

f) Statistical analyses

The cumulative and corrected mortality percentages were submitted to analysis of variance (Mc Clave and Dietrich, 1979) and the differences between the treatments were analyzed by student's t- test.

III. Results and Discussion

a) In vitro study

The yield of the oil extraction was 0.62 %. This yield was higher than that obtain by Pamo et al. (2003) which was 0.50 %. This difference can be explained by many factors including the distillation method and the period during which the plant was harvested.

All the three concentrations tested in the study showed some acaricidal effect on R. lunulatus. Efficiency increased as the concentration of essential oil increased and with the duration of exposure. The highest dose (0.10 µl/g) killed all ticks by day six of exposure while, the lowest dose (0.04 µl/g) caused 80 % of mortality within the eighth day of the trial. By the end of the study, control dose killed only 30% of ticks (Figure 1). This study established that the essential oil obtained from O. gratissimum, and incorporated in soap as carrier was toxic to ticks, and toxicity was directly proportional to the concentration of the essential oil in the soap. The toxicity of these soaps containing essential oil can be mainly attributed to the predominance of Phenolics and Terpenoics compounds present in the essential oil. The main compound of this essential oil is Thymol. This compound is a highly selective chemical substance attacking specific aspects of the endocrine system of insect, thus inducing a toxic effect (Ojimelukwe and Alder, 1999). The high toxicity of this essential oil suggest, that Thymol, known for his insecticidal and acaricidal effect (Tapondjou et al., 2003; Tapondjou et al., 2005; Ndomo et al., 2009) react in synergy with other monoterpens like y-terpinen, p-cymen, terpenoids like β-caryophyllen, and eugenol which insecticidal activities have been documented (Tchoubougnang, 1996; Obeng-Ofory et al., 1997; Tapondjou et al., 2005; Ndomo et al., 2009). Action of phenolics compound such as linalool and y-terpinol is also important. These substances are recognized as important insecticides, fungicides and bactericides (Hassanali et al., 1990; Obeng-ofory et al., 1997). This reality was confirmed by Pamo et al. (2003)

whodemonstrated the acaricidal effect of crude essential oil fromO. gratissimum leaves. Finding from these studies showed that these essential oils which were mainly rich in monoterpen in general and in thymol in particular can induce not only toxic effect but also metabolic disorder in R. lunulatus that may impact their development and reproductive process. The high mortality record in the control group can be explained by other soap components such as soda.

The regression equation derived by comparing the average cumulative mortalities with the concentration of essential oil ($Y=656.25X+11.455$; $R^2=0.9213$; Figure2) revealed that 97.96% of the correlation with mortality doses could be assigned to the concentration of the essential oil.

The adjustment of the average cumulative mortality percentages with doses in time led to the regression equation: $Y= 656.25X +11.455$ ($R^2=0.9213$).

Following the transformation of the mortality percentages to probits at the end of the second day of exposure, the regression line $Y=5.1015X+10.19$ ($R^2= 0.9621$) showed that after 2 days of exposure, the LD_{50} was 0.061μl/g. These confirm the degree of toxicity of soap containing essential oil of O. gratissimum on R. lunilatus.

b) In vivo study

The cumulative mortality of ticks was significantly higher in all treatment groups than the control by third day after treatment. This continued to increase with time in each group. By the end of study, the mortality was almost more than three time higher in group 2 and 3 and four time in group 4 as compared to control (Figure 3). Accordingly, soap containing essential oil at the rate of 0.10μl/g would be effective in completely eliminating the R. lunilatus ticks on goat within a week.

The regression equation ($373.63X+5.473$, $R^2= 0.999$) on mortality versus concentration of essential oil suggests that increasing concentration of essential oil in the soap had increasing effect on ticks.

Similarly, the regression line ($Y= 3.0771X+6.5929$, $R^2= 0.9868$) suggest that by the second day of the treatment, the LD50 was 0.066μl/g. There was no appeared side-effect of the medicated soap application on behaviors and/or health of goats. The in vivo mortalities were relatively lower as compared to those achieved in vitro with LD_{50} of 0.061μl/g. This could be due to the fact that on-farm, the application of medicated soap was carried out on ticks that were allowed to continue feeding. In the laboratory the ticks were not fed, and thus were under stress. This could have weakened them with regard to synergetic activity of the ingredients of the medicated soap.

IV. Conclusion

The essential oil of O. gratissimum is toxic to R. lunilatus ticks, both in vitro and in vivo. The toxic effect of the medicated soap containing the essential oil on ticks increased as the concentration of essential oil increased and persisted during the entire period of the study. A low LD50 (0.061μl/g for in vitro and 0.066μl/g for in vivo application) of the essential oil suggests that it bar potential or acaricidal agent for R. lunilatus ticks. Further studies on the chemical nature of the components of essential oil as well as the separation of the different fractions would improve our Knowledge and understanding. Identification of the active ingredient in the essential oil would improve quality and efficiency of the product. The effects of this essential oil on other tick species need to be studied. Likewise, the effect of repeated application of the medicated soap on adults ticks and their others life stage needs some evaluation.

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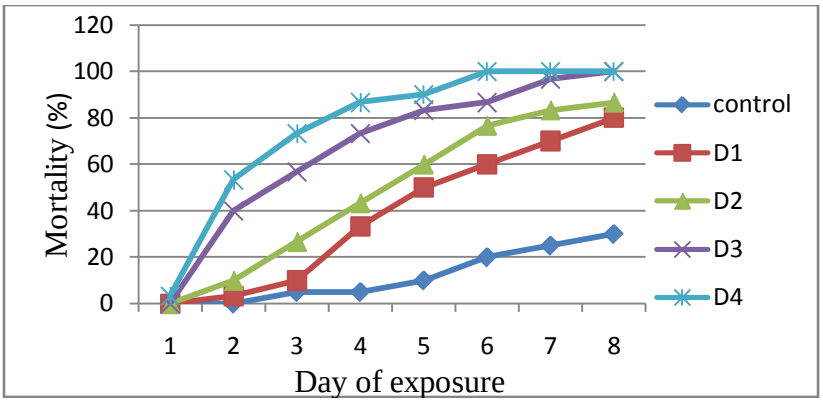

Figure 1 : Cumulative ticks mortality (%) following in vitro treatment with soap containing different doses of O. gratissimum leaves essential oil

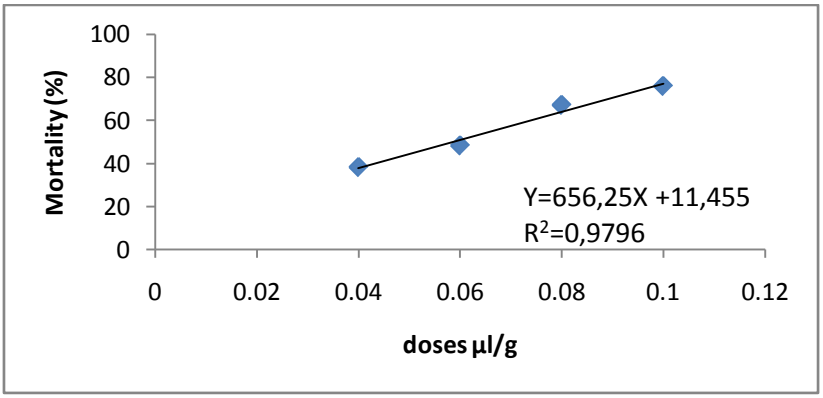

Figure 2 : Regression line of the cumulative mortality of R. lunulatus and concentration of essential oil

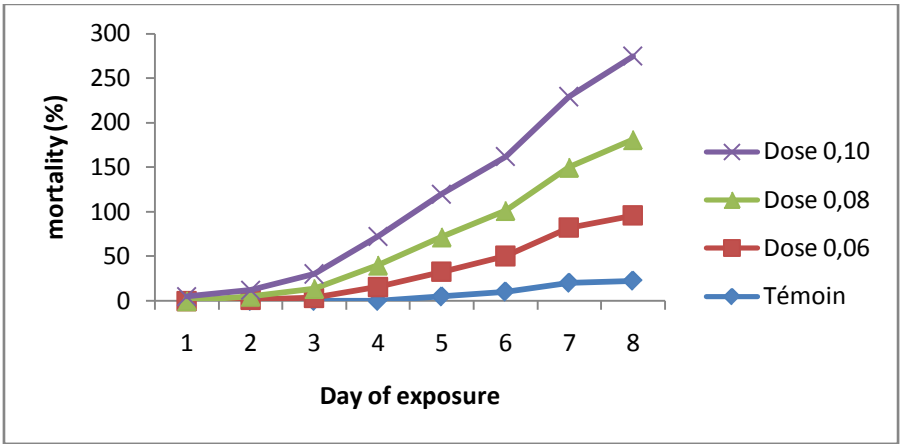

Figure 3 : Cumulative ticks mortality (%) following in vivo treatment with soap containing different doses of O. gratissimum leaves essential oil

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Seasonal Productivity of Flemingia Macrophylla under Different Defoliation Frequencies

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Abstract- Flemingia macrophylla is introduced and established with the aim of helping to mitigate the dry season fodder deficit in many developing countries. A study was carried out to assess the effect of season and defoliation frequency on the fodder yield and the chemical constituents of F. macrophylla. The experiment was conducted using a Randomized Complete Block Design (RCBD) with 2 2 factorial arrangements of treatments for four-years-old mature stands of F. macrophylla. Dry and wet were the levels of season factor and three months and six months defoliation intervals were the levels of defoliation frequency. Each treatment was replicated for five times. The nutrient contents of fodders were determined using proximate analysis. The results showed that the plants harvested on wet season had higher ($p<0.01$) dried fodder yield than the plants harvested in dry seasons. The plants defoliated in three months interval had yielded higher ($p<0.001$) annual fodder biomass than the plants defoliated in six months interval. Likewise, the fodder harvested in the wet season had better nutrient composition compared to the fodder harvested in dry season. Similarly, the fodder harvested in three months defoliation interval had better nutrient composition than the fodders harvested in six months defoliation. The results revealed that the seasonal variation in dry and wet season yields of F. macrophylla was prominent, and harvesting of the fodder in three months defoliation interval could be the better practice in comparison to defoliation in six months interval in order to produce higher fodder yield with better nutrient composition.

Keywords: *season, defoliation frequency, fodder yield, nutrient composition.*

GJSFR-D Classification : *FOR Code: 079999*

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I. Introduction

Fodder production is the integral part of the ruminant production system. The ruminant animals are more dependent on the forage based system, especially in the developing countries. In this context, cultivation of different species and cultivars of fodders to feed livestock is a common practice. But, fodder deficit, especially in the dry seasons, is one of the major problems in many of the Asian, African and Latin American countries (Egan, 1997; Upreti and Shrestha, 2006; Pariyar et al., 2013). In order to mitigate the fodder deficit situations, many fodder species are being introduced and established with the aim of year round fodder production. Most of the established species and cultivars are more productive in wet seasons but the fodder yield drastically reduced in winter. The yield of the perennial fodder legumes, like other non-leguminous species, is more often influenced substantially by the season and defoliation frequency (Smith, 1992).

Use of shrubs and tree fodders for the sustainability of the year round fodder production is one of the accepted methods of overcoming the problems of dry season fodder deficit (Raynolds, 1995). Flemingiamacrophylla is a multipurpose perennial fodder legume species, especially popular for dry season fodder (Budelman and Siregar, 1997) with excellent coppicing capacity and re-growth after defoliation (Anderson et al., 2002). It is high biomass yielding and higher crude protein containing species of fodder shrubs which improves the soil fertility (Dung et al., 2005). This species had yielded higher fodder biomass with the defoliation interval of three months while compared with two months interval in the previous experiment (Kayastha, 2004). This study was carried out to identify the appropriate defoliation frequency in different seasons for the fodder yield and chemical composition of F. macrophylla aiming to generate suitable defoliation practices.

II. Materials and Methods

The experiment was conducted at the Livestock Farm of Institute of Agriculture and Animal Science, Chitwan, Nepal from July 2008 to June 2009. Geographically, it is located at 27°40' N (latitude) and 84°19' E (longitude) with an altitude of 228 masl. The soil was sandy loam and fairly well drained. The mean soil pH, organic matter, nitrogen, phosphorus and potash contents were 6.17, 2.09 %, 0.14 %, 40.6 kg ha-1 and 146.0 kg ha-1, respectively. Average monthly maximum and minimum temperatures and monthly total rainfall of the experimental duration is presented in Figure (1).

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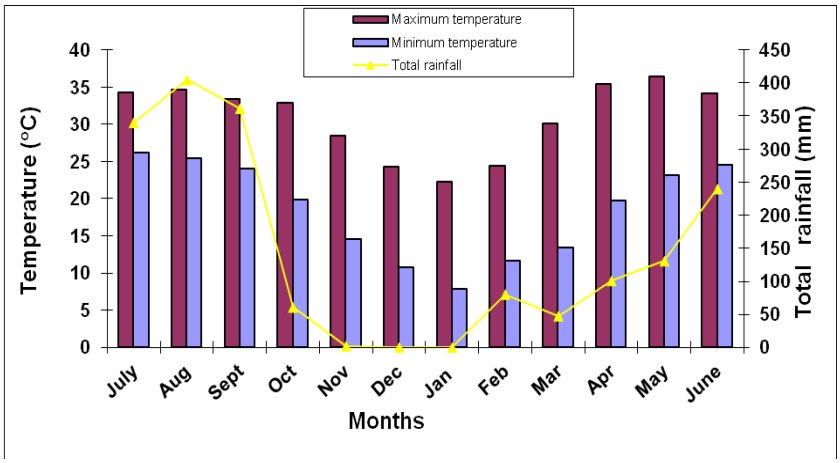

Figure 1 : Mean maximum and minimum temperature and monthly rainfall in different months at Chitwan, Nepal

The experiment was conducted using a Randomized Complete Block Design (RCBD) with 2×2 factorial arrangements. Four treatment combinations of two levels of season (dry and wet) and two levels of defoliation frequency (six months and three months interval) were employed. Each treatment was replicated five times. The experimental plants of four-years-old mature stands of F. macrophylla were used after maintaining the uniform defoliation height of 75 cm and uniform spacing of 90×70 cm. Each experimental plot was of 7.56 m^2 consisting of 12 plants $plot^{-1}$. The number of branches $plant^{-1}$ for different treatments at the beginning of the experiment were also similar (11.32±1.26).

Fresh and dry biomass assessment and sample collection were done at three and six months defoliation interval in both of the seasons. The harvestings were taken twice on wet (June 15 and September 15) and dry season (December 15 and April 15) for three months defoliation interval and once in wet season and once in dry season for six months defoliation interval. Harvesting of fodder was done by defoliating all the experimental plants (12 plants $plot^{-1}$) at 75 cm from the ground level. The leaves with their petioles were detached from the non-edible parts of branches and weighed separately, and the leaf and stem ratio was calculated. The numbers of branches were counted at the defoliation height in every harvesting.

a) Laboratory Analysis

Collected samples of fodders were dried at constant heat in hot air oven at 72°C for 24 hours and dry matter (DM) was estimated. Nitrogen content was determined by Micro Kjheldal method and crude protein (CP) content was calculated (AOAC, 1990). Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were determined using the method developed by Van Soest et al. (1991).

b) Statistical analysis

The data were analysed by using Analysis of Variance (ANOVA) technique. The statistical analyses were carried out by using GenStat Discovery Edition (2011). Alpha level was set as 0.05

III. Results and Discussion

a) Fodder yield

The effect of season and defoliation frequency was significant on the annual fodder yield of F. macrophylla (Table 1). The number of branch $plant^{-1}$ was similar ($p>0.05$) for both the seasons, dry and wet. Likewise, the effect of defoliation frequency was similar to the number of branch $plant^{-1}$. Branch heights were also similar ($p>0.05$) for the dry and wet seasons. But, the plants defoliated in six months interval had attained taller branch height than the plants defoliated in three months interval. The leaf and stem ratio was better ($p<0.05$) in the wet season compared to dry season. The fodder dry matter yield in the wet season was higher ($p<0.01$) than the yield during dry season (5.93 t ha^{-1} Vs 4.31 t ha^{-1}). Likely, the plants defoliated in three months interval had yielded higher ($p<0.001$) fodder dry matter (6.39 t ha^{-1}) compared to the plants defoliated in six months interval (Table 1).

Table 1: Effect of season and defoliation frequency on the fodder yield and yield attributing characters

Treatments	Number of branch plant^{-1}	Average branch height (cm)	Leaf: stem ratio	Fodder yield (DM, t ha^{-1})
Season				
Dry	13.74	134.3	1.55	4.31
Wet	14.87	141.7	1.91	5.93
SEM	0.86	3.70	0.13	0.43
F-Probability	NS	NS	<0.05	<0.01
Defoliation frequency				
3 months interval	13.75	130.6	2.33	6.39
6 months interval	14.86	145.3	1.19	3.86
SEM	0.86	3.70	0.22	0.43
F-probability	NS	<0.001	<0.001	<0.001

The interaction effects of the season and defoliation frequency on the annual fodder yield has been presented in Table 2. The number of branch was not affected ($p>0.05$) by the season and the defoliation interval, whereas the difference among the branch height was significant ($p<0.01$). The plants defoliated in six months interval had resulted taller branch height in both dry and wet seasons. Higher ($p<0.001$) leaf: stem ratio was obtained from the plants defoliated in wet season with three months interval. It was followed for the treatment of dry season defoliation with three months interval. Highest fodder dry matter yield (7.62 t ha^{-1}) was obtained from the plants defoliated in three months interval at wet season ($p<0.001$), and was followed by the treatment of three months defoliation interval in dry season (5.15 t ha^{-1}). The plants defoliated in the dry season and six months interval had shown lowest fodder yield.

Table 2 : Interaction effects on season and defoliation interval on the fodder yield and yield attributing characters

Treatments	Number of branch (plant^{-1})	Branch height (cm)	Leaf:stem ratio	Fodder yield (DM, t ha^{-1})
Dry season × 3 months interval	12.62	126.0	2.06	5.15
Dry season × 6 months interval	14.86	142.6	1.16	3.47
Wet season × 3 months interval	14.87	135.2	2.95	7.62
Wet season × 6 months interval	14.86	148.1	1.23	4.24
SEM	1.22	5.23	0.38	0.60
F-probability	NS	<0.01	<0.001	P<0.001

b) Nutrient composition

Nutrient compositions of the fodders for different treatments are presented in Table 3. The dry matter content and acid detergent lignin (ADL) content of the fodder were higher in the dry season than in the wet season. But, CP content and calcium (Ca) content were higher in the fodders harvested in the wet season in comparison to the fodders for dry season. Similarly, the effects of defoliation interval was significant ($p<0.05$) in the nutrient composition. The dry matter content was higher for the fodder defoliated in six months interval than in the three months. Likewise, the detergent fractions (NDF, ADF and Lignin) and Ca content were also higher ($p<0.05$) in the fodder defoliated in the six months than in the fodder defoliated in three months interval. But, the CP content was better ($p<0.05$) for the fodder defoliated in three months than in the fodder defoliated in the six months interval. Likewise, P content was also higher ($P<0.001$) in the fodder harvested in three months interval than six months interval.

Table 3 : Nutrient composition of the fodders defoliated in different seasons and intervals, %

Treatments	DM	CP	NDF	ADF	Lignin	Ca	P
Season							
Dry	30.89	16.60	56.46	45.37	32.31	1.38	0.27
Wet	28.61	17.75	54.49	46.75	30.14	1.16	0.28
SEM	0.33	0.21	0.85	0.86	0.65	0.04	0.01
F-Probability	<0.001	<0.001	NS	NS	<0.05	<0.001	NS
Defoliation frequency							
3 months interval	27.37	17.43	54.01	43.91	30.05	1.14	0.29
6 months interval	32.13	16.91	56.94	48.20	32.41	1.39	0.25
SEM	0.33	0.21	0.85	0.86	0.65	0.04	0.01
F-probability	<0.001	<0.05	<0.05	<0.001	<0.05	<0.001	<0.001

The interaction effects of the season and defoliation frequency on the nutrient content of the fodders are presented in Table 4. Dry matter content was similar ($p>0.05$) for all the treatments. Similarly, the detergent fractions, viz. NDF, ADF and Lignin were not also influenced by the treatments ($p>0.05$). The P content were also similar for different treatments ($p>0.05$). But, CP content and Ca content were influenced. The treatments of wet season harvests with three months defoliation interval, the dry season harvests with three months defoliation interval and wet season harvests with three months defoliation interval had yielded higher ($p<0.01$) proportion of CP than the treatment of dry season harvest with six months defoliation interval. Similarly, the fodder having the treatment of dry season harvest with six months defoliation interval had the higher content of Ca ($p<0.05$).

Table 4 : Interaction effect of the season and defoliation frequency on the major nutrient composition of the fodders, %

Treatments	DM	CP	NDF	ADF	Lignin	Ca	P
Dry season × 3 months interval	28.68	17.59	55.28	43.29	30.77	1.19	0.29
Dry season × 6 months interval	33.10	15.92	57.65	47.45	33.86	1.57	0.25
Wet season × 3 months interval	26.06	17.90	52.75	44.54	29.33	1.09	0.30
Wet season × 6 months interval	31.17	17.27	56.23	46.96	30.96	1.22	0.25
SEM	0.46	0.29	1.20	1.22	0.92	0.05	0.01
F-probability	NS	<0.01	NS	NS	NS	<0.05	NS

IV. Discussion

The number of branch was neither affected by the seasons nor by the defoliation frequency in the mature stands of F. macrophylla (Table 1). Branch height was not affected by the season, but influenced by the defoliation frequency. The plants with longer growing period of six months defoliation interval had attained the taller height of the branches. With the similar number of branches and branch heights, the leaf and stem ratio was higher ($p<0.05$) in the wet season. The similar results were obtained for the dried fodder yield. The fodder yield of F. macrophylla was significantly higher ($p<0.01$) in the wet season in comparison to dry season. Comparing the higher biomass yield in wet seasons with climate pattern (Figure 1), higher rainfall and higher temperature could have accelerated the foliage growth rate. These significant influences of the seasons caused the seasonal variations in the yield of F. macrophylla like in other leguminous fodder trees which was also reported by Ivory (1989). The results of this study was in the agreement with the results of another experiment that the monsoon harvest of F. macrophylla was higher than the winter harvest in the similar climatic condition of Nepal (Kayastha, 2004). The winter foliage production of F. macrophylla could be slow due to low temperature and due to decrease in the activity of root nodules bacteria in legumes (Barnes, 1998).

Defoliation frequency did not affect the number of branches, whereas branch height was taller ($p<0.001$) for the plants defoliated in six months interval. The plants defoliated in three months interval had yielded higher leaf and stem ratio which indicated the higher leaf biomass. The dried fodder yield was higher ($p<0.001$) from the plants defoliated in three months interval compared to the plants defoliated in six months interval (Table 1). The appropriate defoliation interval for F. macrophylla was observed to be 3 month. In a previous study, Kayastha (2004) obtained the better fodder yield from the plants defoliated in three months interval compared to the plants defoliated in two months interval in the similar field and climatic conditions.

The branch height, leaf and stem ratio and dried fodder yield was significantly influenced by the interaction effect of seasons and defoliation intervals (Table 2). Although, the branch height was taller for the

plants defoliated on wet season with six months interval and the plants defoliated on dry season with six months interval, the leaf and stem ratio and fodder dry matter yield were better for the plants defoliated on wet season with three months defoliation interval and the plants defoliated on dry season with three months defoliation interval. The results of this study agree with the findings of Asare (1985) that the defoliation interval depends upon the climatic conditions. In the experiment also, F. macrophylla responded better during wet than cool and dry season. The results from another study on Gliricidia and Leucaena had revealed that the foliage growth and retention appeared lower during the dry season, demonstrating the seasonal influence under frequent defoliation (Smith, 1992). The results of this study also support the findings in the case of F. macrophylla.

a) Nutrient composition

The fodder of F. macrophylla harvested in dry season had higher ($p<0.001$) DM and Ca content than in the fodders harvested in wet season, whereas crude protein content was better in wet season (Table 3). The detergent fractions, except lignin, were not affected by the season. The result was in agreement with Smith (1992) that the season of defoliation affects the nutrient composition of the tree and shrub fodders (Smith, 1992). The higher concentration of CP and mineral content is a main feature of the legume browse plants and the concentration of CP in those fodder trees and shrubs is obtained higher even in the dry season when it tends to decrease (Dicko and Sikena, 1992). The fodder of F. macrophylla could be considered a good quality fodder while it content higher CP and mineral even in dry season (16.60% CP, 1.38% Ca and 0.27% P).

Delayed maturity alters certain nutrients composition in the fodder (Kamalak et al., 2005). The dry matter and detergent fractions were increased and CP and P concentration were decreased with the longer defoliation interval (six months). Similar results were obtained in another study on Puerariaphaseoloides that increased detergent fractions and decreased CP due to increased cutting interval (Nguyen Van Hiep et al., 2008). Similarly, increasing the defoliation interval had decreased CP content of the fodder of Leucaenaleucocephala, Gliricidiasepium and Trichanthera gigantean in another experiment (Edwards et al., 2012). Calcium content was also increased in delayed harvests (Table 3). Significant increment of detergent fraction in the fodder defoliated in six months interval, especially lignin content is the indicator of reduced digestibility of the fodders to the animals. The fodder harvested in three months interval was considered better quality due to the significantly higher ($p<0.05$) content of CP and P and lower content of lignin.

V. Conclusion

The perennial leguminous fodder F. macrophylla had shown greater response of seasons and defoliation frequency on the fodder yield and quality. Yield was higher in the wet season and in the shorter defoliation interval of three months. The nutrient compositions were also obtained better for wet season and three months defoliation interval. It is clear that better fodder yield could be obtained in wet season from F. macrophylla three months defoliation interval, although, this perennial fodder legume had shown considerable fodder yield in dry season as well. This fodder species could contribute substantially if used in the year round fodder management packages.

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- Left Margin: 0.65
- Right Margin: 0.65
- Top Margin: 0.75
- Bottom Margin: 0.75
- Font type of all text should be Swis 721 Lt BT.
- Paper Title should be of Font Size 24 with one Column section.
- Author Name in Font Size of 11 with one column as of Title.
- Abstract Font size of 9 Bold, "Abstract" word in Italic Bold.
- Main Text: Font size 10 with justified two columns section
- Two Column with Equal Column with of 3.38 and Gaping of .2
- First Character must be three lines Drop capped.
- Paragraph before Spacing of 1 pt and After of 0 pt.
- Line Spacing of 1 pt
- Large Images must be in One Column
- Numbering of First Main Headings (Heading 1) must be in Roman Letters, Capital Letter, and Font Size of 10.
- Numbering of Second Main Headings (Heading 2) must be in Alphabets, Italic, and Font Size of 10.

You can use your own standard format also.
Author Guidelines:

1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

1. GENERAL

Before submitting your research paper, one is advised to go through the details as mentioned in following heads. It will be beneficial, while peer reviewer justify your paper for publication.

Scope

The Global Journals Inc. (US) welcome the submission of original paper, review paper, survey article relevant to the all the streams of Philosophy and knowledge. The Global Journals Inc. (US) is parental platform for Global Journal of Computer Science and Technology, Researches in Engineering, Medical Research, Science Frontier Research, Human Social Science, Management, and Business organization. The choice of specific field can be done otherwise as following in Abstracting and Indexing Page on this Website. As the all Global

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2. ETHICAL GUIDELINES

Authors should follow the ethical guidelines as mentioned below for publication of research paper and research activities.

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Authorship: The authors and coauthors should have active contribution to conception design, analysis and interpretation of findings. They should critically review the contents and drafting of the paper. All should approve the final version of the paper before submission

The Global Journals Inc. (US) follows the definition of authorship set up by the Global Academy of Research and Development. According to the Global Academy of R&D authorship, criteria must be based on:

1) Substantial contributions to conception and acquisition of data, analysis and interpretation of the findings.

2) Drafting the paper and revising it critically regarding important academic content.

3) Final approval of the version of the paper to be published.

All authors should have been credited according to their appropriate contribution in research activity and preparing paper. Contributors who do not match the criteria as authors may be mentioned under Acknowledgement.

Acknowledgements: Contributors to the research other than authors credited should be mentioned under acknowledgement. The specifications of the source of funding for the research if appropriate can be included. Suppliers of resources may be mentioned along with address.

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3. SUBMISSION OF MANUSCRIPTS

Manuscripts should be uploaded via this online submission page. The online submission is most efficient method for submission of papers, as it enables rapid distribution of manuscripts and consequently speeds up the review procedure. It also enables authors to know the status of their own manuscripts by emailing us. Complete instructions for submitting a paper is available below.

Manuscript submission is a systematic procedure and little preparation is required beyond having all parts of your manuscript in a given format and a computer with an Internet connection and a Web browser. Full help and instructions are provided on-screen. As an author, you will be prompted for login and manuscript details as Field of Paper and then to upload your manuscript file(s) according to the instructions.

To avoid postal delays, all transaction is preferred by e-mail. A finished manuscript submission is confirmed by e-mail immediately and your paper enters the editorial process with no postal delays. When a conclusion is made about the publication of your paper by our Editorial Board, revisions can be submitted online with the same procedure, with an occasion to view and respond to all comments.

Complete support for both authors and co-author is provided.

4. MANUSCRIPT'S CATEGORY

Based on potential and nature, the manuscript can be categorized under the following heads:

Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications

Research letters: The letters are small and concise comments on previously published matters.

5.STRUCTURE AND FORMAT OF MANUSCRIPT

The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

Structure

All manuscripts submitted to Global Journals Inc. (US), ought to include:

Title: The title page must carry an instructive title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) wherever the work was carried out. The full postal address in addition with the e-mail address of related author must be given. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining and indexing.

Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

Tables, Figures and Figure Legends

Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.

Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

Preparation of Electronic Figures for Publication

Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

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6. AFTER ACCEPTANCE

Upon approval of a paper for publication, the manuscript will be forwarded to the dean, who is responsible for the publication of the Global Journals Inc. (US).

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The corresponding author will receive an e-mail alert containing a link to a website or will be attached. A working e-mail address must therefore be provided for the related author.

Acrobat Reader will be required in order to read this file. This software can be downloaded

(Free of charge) from the following website:

www.adobe.com/products/acrobat/readstep2.html. This will facilitate the file to be opened, read on screen, and printed out in order for any corrections to be added. Further instructions will be sent with the proof.

Proofs must be returned to the dean at dean@globaljournals.org within three days of receipt.

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TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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