Chapter 1: INTRODUCTION

Drugs synthesized from medicinal plants are used worldwide for the treatment of several diseases and also act as important sources of raw material for pharmaceutical industries (Martins, 2013). In recent time, the use of herbal medicines mostly in rural areas has increased worldwide, due to limited modern facilities, hence making the health care system completely dependent on such plants/herbs (Trease and Evans, 1996). These therapeutic plants have application in pharmaceutical, horticultural and sustenance industry (Fawzi, 2013).

Azadirachta indica (Neem) and *Moringa oleifera (Sogina)* belong to the family Meliaceae and have a long history of utilization as a treatment against different diseases (NRC, 1992). Leaves, bark, natural products, seed, gum and oil are some greatest valuable non-wood items that gives neem leave superiority over some other tree species (Eleazu et al., 2012). These non-wood items are known to have anti-allergenic, antifungal, anti-inflammatory, anti- and several other biological activities (Pallav, 2014). As a result of these numerous applications, neem leaves have discovered huge applications making it a green fortune. Ancient medicinal findings, suggested that the concentrates from neem leaves are recommended in for diarrhea and intestinal infections, skin ulcers and infections, and malaria (Jennifer and Alasdair, 2000). The medical value of the plants lies in some chemical substances that deliver an unmistakable physiological activity on the human body (Edeoga et al., 2005). Phytochemical compositions such as alkaloids, tannins, flavonoids, and phenolic compounds, form the most important of these bioactive constituents of plants are (Madakiet al., 2016). The knowledge of medicinal plants has been valuable in this generation of medication and production of other substances such as food, spice and perfume (Abayomi, 1993). In ancient immemorial period Neem has been used as adisincentive agent against highly contagious smallpox and other infectious diseases and was also regarded to defend against evil spirits from time (Kumar and Navaratnam, 2013). In old medicinal system medications and applications were compiled over palm leaves and they have been passed on from generations to generations. In the Indus civilization the use of Neem tree is as old as 4500 years during the period of Harappa culture (one among the great civilisation in the world). Writing palm leaf manuscript is among the oldest medium of conserving knowledge in India to store the history of herbal heritage. Centre for Traditional Medicine and Research (CTMR), Chennai. India revealed the medicinal uses of different parts viz, fruits, seeds, leaves, roots, bark etc., of Neem trees. It explains use of neem flower against bile disorders, neem leaves to prevent and treat ulcers and neem bark to brawl against paralysis and CNS disorders (Bandyopadhyay et al., 2004). Old evidences obtained from two great civilizations Harappa and Mohenjo-Daro of ancient world also witnessed that *Azadirachta* *indica* the prominent herb of therapeutic importance at that time not only in Indian context but in world as well. According to epic of Mahabharata, Nakul and Sahadeva used Neem oils for treatment of wounds in horses and elephants (Bandyopadhyay et al., 2004). They have been used in traditional practices for treating inflammation and infections; fever, skin diseases as well as dental disorders. The leaves as well as its constituents use to exhibit immunomodulatory as well as anti-inflammatory and antihyperglycemic activities; antiulcer; antimalaria; antifungal; antibacterial; antiviral; antioxidant; antimutagenic as well as anticarcinogenic characteristics (Beuth et al., 2006; Akihisa et al., 2009; Rakib and Hussain 2013). Neem plant preparations are also used by the natural healers for diverse disorders such as leprosy, gastrointestinal problems, malaria, intestinal helminthiasis, tuberculosis, ringworms, skin disorders, boils, epilepsy, fever, respiratory distress, nausea, ulcers and in health industries also (Biswas et al., 2002; Bhowmik et al., 2010; Pankaj et al., 2011). Modern scientists are exploiting more uses of this special tree. Different parts of neem plant such as bark, stems, leaves, fruits, flowers and seeds possess compounds such as flavonoids, tannins, flavonoglycosides, arabino fucoglucanes and others with proven immunomodulatory, antiseptic, diuretic, emmenagogue, febrifuge, antipyretic, antidiabetic, anthelmintic, anti-inflammatory, analgesics, antifeedant, antiviral, antifungal, contraceptive, in Vitro spermicidal, insecticide, pediculicide, parasiticide, antimutagenic and antiulcer properties since antiquity (Al-Samarrai et al., 2012; Delserrone and Nicoletti, 2013; Mukherjee and Sengupta, 2013). In traditional Indian system, Neem leaves were used to cover the patient of chicken pox and the patient was suggested to sleep under neem tree. In an experimental study on rats, neem leaf extract has been reported beneficial in treatment of carbon tetrachloride led liver damage (Mujumdar, 1998). Neem Leaf Meal (NLM) may be useful ingredient in diet of broilers due to its medicinal and nutritional importance (Bonsu et al., 2012). Nimbidiol present in root and bark of neem tree can inhibit intestinal glucosidases thus helpful in control of diabetes (Mukherjee and Sengupta, 2013). In modern era, emphasis should be on control of diseases of human, animals and environment using non-toxic herbal products. By making quantum of research on biological and medicinal properties of neem, some of the herbal products have been prepared but still there is lot of scope in this field for better utilization of this wonder plant (Tiwari et al., 2014).

Moringa oleifera belongs to the genus Moringaceae. A single genus with 14 known species, *M. oleifera* is the most widely known and utilized of these (Morton, 1991). *Moringaoleifera* is a fast growing, aesthetically pleasing tree. The specie is characterized by its long, drumstick shaped pods that contain its seeds within the first year of growth. Moringa has been shown to grow up to 4 meters and can bear fruit within the same first year (Oleveria et al., 1999). The tree ranges in height from 5–12 m and the fruits (pods) are around 50 cm long. *Moringa oleifera* is esteemed as a versatile plant due to its multiple uses. The leaves, fruits, flowers and immature pods of this tree are edible and they form part of traditional diets in many countries of the tropics and sub-tropics (Siddhuraju & Becker, 2003; Anhwange et al., 2004). The leaves of M. oleifera are a good source of protein, vitamin A, B and C and minerals such as calcium and iron (Dahot, 1988). Almost every part of the tree is of value for food. In Malaysia, the young tender pods are cut into small pieces and added to curries. Almost all parts of the tree have been utilized within traditional medicine practices and the oil is applied externally for skin diseases (Foidl et al., 2001). The flowers, leaves and roots are used for the treatment of ascites, rheumatism and venomous bites and as cardiac and circulatory stimulants in folk remedies. The roots of the young tree and also root bark are rubefacient and vesicant (Hartwell, 1995; Anwar & Bhanger, 2003). The seeds are sometimes removed from more mature pods and eaten like peas or roasted like nuts. Different parts of this plant contain a profile of important minerals, and are a good source of protein, vitamins, beta-carotene, amino acids and various phenolics (Anwar et al., 2007). The seed cake remaining after oil extraction may be used as a fertilizer (Rashid et al., 2008). Based on some of the antioxidant and phytochemical properties possessed by the leaves of Moringa, it iscapable of being used as a natural anticancer, antihypertensive, diuretic, antispasmodic, antiulcerantihelmintic, antibiotic, detoxifying and immune building agent and also possess some cholesterol lowering. Nutritionally, the leaves have been found to be a valuable source of both macro and micronutrients, rich source of -carotene, calcium and potassium. It also contains high content of highly Phytochemical, antioxidant and anti-protease digestible protein, carotenoids, minerals and vitamins components of *Moring aoleifera* leaf was determined especially vitamin C, hence it can be used as an ideal nutritional supplement which have been used to combat malnutrition, especially among infants and nursing mothers. The leaves and pods have also been indicated to increasing breast milk in nursing mothers during breast feeding. In animal husbandry, broilers with diet supplemented with moringa leaf has taken found to improve the performances of the significantly. The *Moringa oleifera* plant has also be used in the treatment of psychosis, eye diseases, asthma, back pain, rheumatism and fever and as an aphrodisiac.

The chemical compositions of the leaves of these plants in Bangladesh are not fully harnessed to reflect the immense medicinal properties, hence are poorly administered without precaution to its health hazard. Day by day increase in population results in pressure and fast depletion of natural resources. In order to meet various human needs attention should be paid on diversification of the present-day agriculture. Medicinal plants and herbs are of great importance to the health of individuals and a scientific investigation of traditional herbal remedies for metabolic disorders may provide valuable lead for the development of alternative drug and therapeutic strategies (Kochhar et al., 2006). In order to face the problem of food scarcity, fruits can be utilized for the good source of nutrients and food supplements. Fruits are commonly well known for the excellent source of nutrients such as minerals and vitamins; and also contain carbohydrates in form of soluble sugars, cellulose and starch (Nahar et al., 1990). Fruits are very vital portion of an adequate diet and they serve as food supplement, and an appetizer. The fruits, seeds and leaves of many wild plants already form common ingredients in a variety of traditional native dishes for the rural populace in developing countries. However, the comparative chemical composition of different parts of these two leafs is limited. Thus, the present study was conducted to determine the proximate and chemical components present in the leaves, steam and whole plant of *Azadirachta indica* and *Moringa oleifera.*

Objectives of the study:

1. To know the chemical composition of *Azadirachta indica* and *Moringa oleifera.*
2. To use them in ration of animals.

Chapter 2

Review of literature

The proximate, mineral analyses and anti-nutrient compositions of Moringa oleifera (Drumstick) which are commonly used as nutritional and medicinal plant in Nigeria were carried out on both raw and defatted seeds. The nutrient and the anti-nutrients determination were done using various standards. Mean and standard error of means of the triplicate determinations were calculated. The result showed that defatting Moringa oleifera seeds increased the fibre, carbohydrate, vitamins B and C, iron and zinc content and significantly reduced the calcium, potassium and phosphate contents. The result also showed that defatting Moringa oleifera significantly decreased the tannin, alkaloids, saponin, phytate, oxalate levels but increased the cyanogenic glycosides level to a level lower than what is considered toxic to human beings and livestock. (Siddhuraju& Becker, 2003; Anhwange et al., 2004). Hence, the defatted cake could be used in fortification of other food materials. The moisture content for raw sample (9.97± 0.09%) was significantly higher when compared with the defatted (9.40±0.10%). The protein content of raw sample (35.97±0.19%) was significantly higher than that of defatted sample (17.13±0.13%). The crude fat content of the raw sample (38.67±0.03%) was significantly higher than the crude fat content of defatted sample (8.59±0.18%). The crude fibre levels of the raw and defatted samples were 2.87±0.03% and 3.33±0.08% respectively. The fibre in defatted sample was not significantly higher than that of raw sample. The ash contents of the raw and defatted samples were 3.87±0.09% and 3.47±0.07 respectively. The ash in the defatted sample is not significantly different from that of the raw sample. The carbohydrate content in raw sample was 8.67±0.12% and 57.77±0.12% for the defatted sample (Advances in Life Science and Technology
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The proximate composition (crude fibre, ash, fat and protein), of the leaves of *Azadirachta indica*, across the three-collection site in Otukpo Local Government Areas as reveals that among the three-collection site, Market Road had the lowest crude protein (1.22±0.22) % and fat (2.89±0.34) % content but recorded the highest values in Moisture, Ash and fibre composition (14.30±0.02) %, (4.03±0.10) % and (10.86±0.11) % respectively across the collection site. Atangwho et al., 2009 found that the protein, fat contents are lower, ash and fibre than values of 13.42 %, 5.17%, 11.93% and 5.17% respectively recorded in other study.

Native to India and Burma, neem is a botanical cousin of mahogany. It is tall and spreading like an oak and bears masses of honey-scented white flowers like a locust. Its complex foliage resembles that of walnut or ash, and its swollen fruits look much like olives. It is seldom leafless, and the shade it imparts throughout the year is a major reason why it is prized in India. The Subcontinent contains an estimated 18 million neem trees, most of them lined along roadsides or clustered around markets or backyards to provide relief from the sun(Lilot et all., 2000)

Under normal circumstances neem's seeds are viable for only a few weeks, but earlier this century people somehow managed to introduce this Indian tree to West Africa, where it has since grown well. They probably expected neem to be useful only as a source of shade and medicinal especially for malaria but in Ghana it has become the leading producer of firewood for the densely populated Accra Plains, and in countries from Somalia to Mauritania it is a leading candidate for helping halt the southward spread of the Sahara Desert. Among its many benefits, the one that is most unusual and immediately practical is the control of farm and household pests Extracts from its extremely bitter seeds and leaves may, in fact, be the ideal insecticides: they attack many pestiferous species; they seem to leave people, animals, and beneficial insects unharmed (Trojanová, et all.,2018). They are biodegradable; and they appear unlikely to quickly lose their potency to a buildup of genetic resistance in the pests. All in all, neem seems likely to provide nontoxic and long-lived replacements for some of today's most suspect synthetic pesticides. Neem contains several active ingredients, and they act in different ways under different circumstances. These compounds bear no resemblance to the chemicals in today's synthetic insecticides. Chemically, they are distant relatives of steroidal compounds, which include cortisone, birth-control pills, and many valuable pharmaceuticals. Composed only of carbon, hydrogen, and oxygen, they have no atoms of chlorine, phosphorus, sulfur, or nitrogen (such as are commonly found in synthetic pesticides). Their mode of action is thus also quite different.

Neem is famous and celebrated for promoting healthy skin and a clear complexion. Due in part to its bitter taste, it has an incredibly cooling effect on the body, reducing excess heat that can manifest as skin blemishes. Its detoxifying effects on the body make it a great herb for supporting a healthy immune system, especially for the cleansing of natural toxins from the body. The purifying benefits neem has on the body’s blood and circulation also help support healthy blood sugar levels already in the normal range. A healthy digestive environment is vital. Neem reduces unwanted heat and toxins in the GI tract. Neem’s kapha-reducing properties encourage proper fat and water digestion and elimination, keeping water retention from accumulating in the body. The bark, seeds, leaves, fruit, extracts and oils of the Neem tree contain pharmacological constituents which offer some impressive therapeutic qualities, including the following: Anti-viral: capable of destroying viruses Anti-fungal:

able to destroy fungi. Anti-microbial: able to inhibit or destroy the growth of disease-causing organisms. Antibacterial: able to destroy or inhibit the growth of bacteria. Anti-pyretic: able to lower body temperature or prevent or alleviate fever. Anti-inflammatory: able to reduce inflammation.

Anti-tumour: able to reduce the risk of tumour growth Analgesic: able to relieve pain Alterative: able to cure or restore health. Anthelmintic: capable of expelling or destroying parasitic worms. Antiemetic: able to prevent or stop nausea or vomiting Immune system booster and stimulator. Anti-arthritic: effective in treatment of arthritis. Anti-gastric: able to prevent or destroy ulcers. Anti-carcinogenic: reduces the occurrence of cancers Anti-anxiety: capable of preventing depression. Anti-oxidant: preventing atherosclerosis, diabetes, heart disease, Alzheimer's and Parkinson's disease, keeps free radical (cancer cells) under control Neem offers a non-toxic, zero-harm alternative to powerful and sometimes damaging prescription medicines. Numerous active compounds have been isolated from the Neem plant. Some of the most studied include gedunin, sodium nimbinate, salannin, nimbin, azadirachtin, ninbidiol, quercetin and nimbidin(Gupta, et all,2017). Neem leaves contain fibre, carbohydrates and at least ten amino acid proteins. They also contain calcium and other nourishing minerals. Analysis also reveals the presence of carotenoids, nutritive compounds being hailed for their ability to ward off many types of cancer. Neem oil is especially high in important fatty acids, and contains all of these vital nutrients in significant quantities. Researcher believe the high fatty acid content of the oil may be why Neem is so effective for treating many skin ailments. Neem has a very

powerful skin rejuvenating qualities and absorbs quickly into the skin. The uses of Neem to cure human ailments, boost immunity and fortify human health are almost endless. Neem is one of the most powerful known blood purifiers and detoxifiers. Hundreds of specific health maladies respond favourable to the proper application of Neem. This does not include the countless uses of Neem as a natural insect repellent or as a component in beauty aids (Ahlawat et al.)

The Moringa's incredible medicinal usage which is claimed by many cultures and communities based on by science. Through research, the Moringa was found to contain many essential nutrients, for instance, vitamins, (Fahey, 2005; Hsu et al., 2006; Kasolo et al., 2010). It was recently discovered that the Moringa oleifera well as biochemical analysis of a marker of collagen. In the work by Hamza

(2010), treatment with Moringa was found to stimulate hepatoprotective effects against hepatocellular injury by blocking the increase of two serums, aspartate aminotransferase (AST) and alanine aminotransferase (ALT), which are indicators of liver health conditions. In another study by Verma et al., (2012), the effect Moringa oleifera on pylorus ligation-induced, ethanol-induced, cold-restraint stress-induced and aspirin-induced gastric ulcers were investigated. The results of all these tests indicated that the total ulcerogenic effect reduced, by showing a dosedependent anti-ulcerogenic activity by the 50% ethanolic. Throughout the decades to heal a huge amount of acute and chronic conditions. In vitro and in vivo studies with the plant have recommended its effectiveness in treating inflammation, hyperlipidemia, and hyperglycemia (Bennett et al., 2003; Fahey, 2005; Mbikay, 2012). In a study by Caceres et al. (1992), infused Moringa oleifera seeds and roots showed inhibition of carrageenan-induced hind paw edema. The inhibition by the seed infusion conversely was dose-dependent as compared to the root infusion which showed inactivity at certain dosages such as seeds cotyledon, seeds' coat, stem bark, leaves, root bark are reported to possess antimicrobial potential (Arora et al., 2013). Recently, Onsare et al. (2013) have reported preliminary work on the antimicrobial activity Gram negative pathogenic bacteria and yeast strains. In a study by Singh et al. (2012), the antimicrobial activity of Moringa oleifera main model Kirby-bauer disc diffusion method in which displayed anti-bacterial activity however only little mild inhibitory activity and no activity at all against pseudomonas reported that in their study, the promising potential as a treatment for certain bacterial infections. The antibacterial activity of the Moringa species (S. aureus and E. faecalis) than against grampositive species (E. coli, Salmonella, P. aeruginosa, V. parahaemolyticus and A. caviae) which was also indicated in several other studies (Grosvenor et al., 1995; Kudi et al., 1999; Awadh et al., 2001). The anti-diabetic effects of some medicinal plant for diabetes are recognized in different societies (Grove and Altman, 2002). Ajit et al., 2003 reported that hypoglycemic activity of Moringa oleifera, with produced N-Benzyl thiocarbamates, N-benzyl carbamates, benzyl nitriles and a benzyl; which prove to trigger insulin inhibitory activities (Francis et al., 2004) polyphenols, are the main plant compound enhancement of a cell or by free radical scavenging (Du et al., 2010). The leaves of the Moringa oleifera tree have its high number of polyphenols (Sreelatha and Padma, 2009). A comparative study indicated that mature Moringa. The scavenging activity was suggested to be attributed to its hydrogen donating ability (Padma, 2009) al., 2007). In a recent study by Budda et al. (2011), it was stated that Moringa oleifera Lam pod could be a potential chemo preventive agent. The dose dependent administration of boiled Moringa oleifera (MO) caused the incidence and multiplicity of tumours to decrease especially at the highest dose (6.0%) of MO.

Moringa leaves are used as livestock feed and its twigs are reported to be very palatable to ruminants and have appreciable crude protein levels (Sarwatt *et al*., 2002; Murro *et al.*, 2003; Sarwatt *et al.,* 2004; and Sánchez *et al*., 2006a; Mendieta-Araica *et al.*, 2011a; Asaolu *et al.*, 2010, 2011 and 2012; Moyo *et al*., 2012a and Gerbregiorgis *et al*., 2012). The use of forage legumes for supplementation has been suggested as an alternative protein source (Ndmanisho, 1996; Roothaert and Paterson, 1997). However, many tropical fodder legumes contain secondary plant compounds which limit intake and nutrient utilization by ruminant animals (Leng, 1997; Makkar, 1993). *Moringa oleifera* is a non-leguminous multipurpose tree with a high crude protein in their leaves (251.00 g kg^{-1} DM) and a negligible content of tannins and other anti-nutritive compounds (Makkar and Becker, 1996). Therefore, it offers an alternative protein source to ruminants. Another significant characteristic of moringa is higher production of fresh biomass yield per unit area compared with other forage crops to supplement ruminants as protein source (Foidl *et al*., 2002; Sànchez *et al*., 2006b; Fadiyimu *et al*., 2011; Mendieta-Araica *et al*., 2013).

Chapter 3
Materials and Methods

3.1 Sample Collection:

Azadirachta indica and *Moringa oleifera* were collected from three (3) Different locations. This selection point was based on the activities being carried out within and around the sampling point.

Samples collected were wrapped in a black polythene bag and properly labeled before transporting to the laboratory for further analysis.

3.2 Sample Preparation

The fresh samples were dried at room temperature and then grounded into powder using a laboratory grinder to reduce particle size and then kept in plastic containers with properly sealed caps and leveled.

3.3. Proximate Analysis

The proximate analysis of the samples for moisture, total ash, crude fibre, crude protein was carried out in triplicate using methods described by AOAC (AOAC, 2005).

3.3.1 Methodology

Dry Matter (DM): Drying in hot air oven at 105ºC up to constant weight (48-72hours)

% Moisture = (W- W1) *100/W

Here,

W = Weight of fresh or air-dried sample

W1 = Weight of dried sample

Or,

% Moisture = (Weight of crucible before drying +sample- weight of sample – sample after drying) *10 / Weight of sample

DM = 100 - %Moisture

Ash: Fresh or air-dried sample needed to burned in the electric heater within crucible at 150-200℃ up to no smoke. Then ignition of dried sample in muffle furnance at 550-600℃ for 4-6 hours up to white ash.

% Ash = (W-W1) *100/W2

Here,

W= Weight of crucible and ash

W1= Weight of crucible

W2= Weight of sample

Crude Protein (CP): Digestion with concentrated H_2SO_4 and digestion mixture up to clear green residue. Then distillation with 40% NaOH to entrap NH_3 in 2% boric acid solution. After that titration is to be done with 0.1N HCl solution.

%CP = (A*B*0.014*6.25*100)/W

Here,

A= Volume of standard N/10 HCl solution

B= Normality of standard HCl solution

W= Weight of sample

Crude Fiber (CF): Acid boiling for 30 minutes with 1.25% H_2SO_4 at constant volume. Then alkali boiling for 30 minutes with 1.25% NaOH at constant volume. Then burning in heater followed by ignition in muffle furnance for 4- 6 hours.

%CF= (W-W1) *100/W2

Here,

W= Weight of crucible, crude fiber and ash

W1= Weight of crucible and ash

W2= Weight of sample

Chapter 4

Results and Discussion

4.1 Chemical composition of *Moringa olifera* leaf

The effects of different cutting intervals on the chemical composition of moringa leaves are presented in Table 1 DM% content of Moringa oleifera leaf in 6 weeks is higher than 8 weeks which are 28.51% and 23.855% respectively. Moisture content is also higher in 6 weeks (76.15%) than 8 weeks (71.49%). According to Adelegan Olufunke, S.O. Asoso and P.T. Olagbemide (DOI: 10.5829/idosi.abr.2015.9.6.96112) levels of moisture is (72.88%) which is between the range of moisture content of 6 weeks and 8 weeks aged plant. Ash content is found higher in 8 weeks (8.06%) than 6 weeks (7.94%). According to Afe Babalola, Iyadunni Adesola, Anuoluwa U (DOI: 10.5829/idosi.abr.2015.9.6.96112) ash content is (9.88%) which is higher than the value we found. CP content is higher in 6 weeks (28.59%) than 8 weeks (22.40%). According to Adelegan Olufunke, S.O. Asoso and P.T. Olagbemide (DOI: 10.5829/idosi.abr.2015.9.6.96112) the proximate analysis of dried leaf of *M. oleifera* showed that it is highly rich in protein (28.00±0.33%) which is near the value of CP content of 6 weeks plant. CF content is found higher in 8 weeks (13.65%) than 6 weeks (8.75%). According to Afe Babalola, Iyadunni Adesola, Anuoluwa U (DOI: 10.5829/idosi.abr.2015.9.6.96112) crude fibre is (12.57±0.28%) which is near the value of CF of 8 weeks aged plant and higher than 6 weeks aged plant. In another study Nivas Manohar Desai, et all. (2010) moisture content of Moringa is 43.32%, CP % is 8.32 -9.13%, CF% is 33%. This result shows variation from our results.

Table 1: Chemical composition of *Moringa oleifera* leaf at different cutting intervals (Mean ±SE; n = 4)

Variables	Cutting interval (weeks)		P value	Level of significance
	6	8		
DM (%)	23.85[b]	28.51[a]	0.046	*
Moisture (%)	76.15[a]	71.49[b]	0.04	*
Ash (%)	7.94	8.06	0.85	NS
CP (%)	28.59 [a]	22.40 [b]	0.02	*
CF (%)	8.75 [b]	13.65 [a]	0.03	*
OM (%)	91.93	92.05	0.85	NS

[a,b,c] Means in the same row and in each treatment with different superscripts differ significantly among cutting interval at P<0.05 level; n= observation numbers.

4.2 Chemical composition different parts of *Azadirachta indica* (Neem)

The Chemical composition different parts of *Azadirachta indica* (Neem) leaf are presented in Table 2 In our study DM% of neem foliage, leaf, stem are 34.79%, 32.42%, 37.87% respectively. It is observed that neem stem contents more dry matter than leaf and foliage. Moisture contents are respectively 65.21%, 67.58%, 62.13% which shows neem leaf has more moisture content than foliage and stem. Ash content of neem is 8.815% in foliage, 9.82% in leaf, 6.33% in stem which means leaf content more ash. CP% of foliage is 12.75%, leaf is 14.07%, stem is 5.28%. Leaf content more protein than other part of plant. CF% of foliage is 19.33%, leaf is 12.50%, stem is 42.95%. Here stem content more fiber. In other study Moisture, Ash, CP, CF of neem plant shows result 14.30±0.02%, 4.03±0.10%, 1.22±0.22%, 10.86±0.11% (A. Otache.et *al.*,2017) which are much lower than the value we found. These values are also lower than the values of 13.42% protein, 11.93% ash and 5.7%fiber recorded in other study (Atangwho *et al*., 2009)

Table 2: Chemical composition of different parts of *Azadirachta indica (*Neem*)* (Mean ±SE; n = 3)

Variables	Neem tree			P value	Level of significance
	Foliage	Leaf	Stem		
DM (%)	34.79^{b}	32.42^{b}	37.87^{a}	0.01	*
Moisture (%)	65.21^{a}	67.58^{a}	62.13^{b}	0.01	*
Ash (%)	8.81^{b}	9.82^{a}	6.33c	0.001	**
CP (%)	12.75^{b}	14.07^{a}	5.28^{c}	0.001	**
CF (%)	19.33^{b}	12.50^{c}	42.95^{a}	0.001	**
OM (%)	91.19^{b}	90.17^{c}	93.67^{a}	0.001	**

[a,b,c] Means in the same row and in each treatment with different superscripts differ significantly among cutting interval at $P<0.05$ level; n= observation numbers.

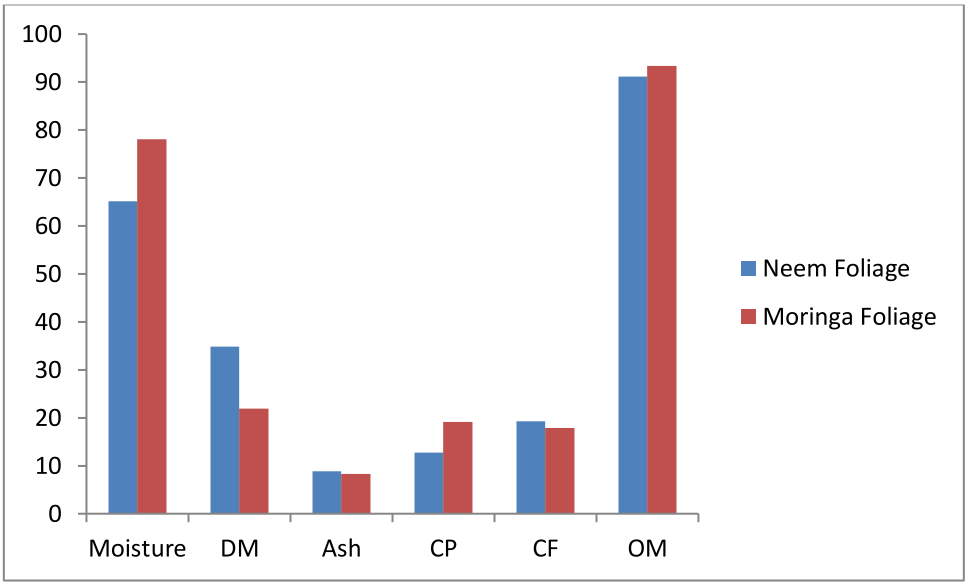

FIG1. Comparison of chemical composition between Moringa and Neem foliage

4.3 Comparison of chemical composition between Moringa and Neem foliage

Fig 1 represents the comparative chemical composition of Moringa and Neem foliage. In our study it was observed that moisture content is higher in Moringa (76.15%) foliage than Neem (65.21%). That's mean neem (34.79%) content more DM than Moringa (28.51%) which also found in our study. Ash content of both plants are nearly similar but neem plant contains slightly higher Ash (8.81%). CP content is found higher in Moringa (28.59%) foliage than neem (12.75%). CF content is found higher in Neem (19.33%) than Moringa (8.75%).

4.4 Comparison of chemical composition between Moringa and Neem Leaf

Comparative chemical composition of Moringa and Neem Leaf is shown in Fig 2. Moisture content of Moringa leaf (78.06%) is higher than Neem leaf (67.576%). So, DM content will be higher in Neem leaf (32.42%) than Moringa (21.94%). That is what we found in our experiment. Ash content in Neem (9.82%) is higher than Moringa leaf (8.24%). CP and CF content of Moringa (19.11%, 17.83%) are higher than Neem leaf (14.06%, 12.49%).

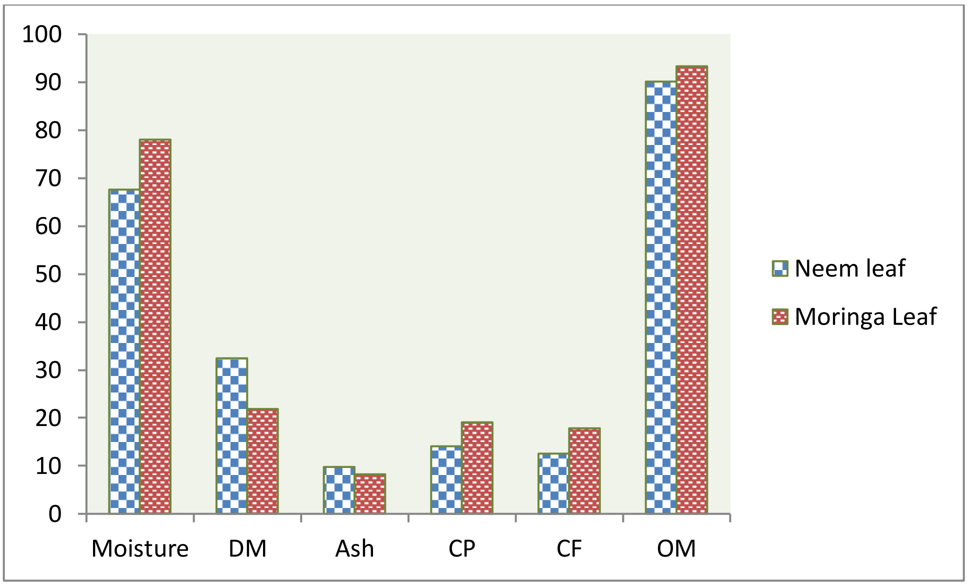

FIG 2. Comparison of chemical composition between Moringa and Neem Leaf

4.5. Comparison of chemical composition between Moringa and Neem stem

Moringa and Neem comparative chemical composition is represented in Fig 3. From fig 3 it was observed that the moisture content of Moringa (91.02%) stem is higher than Neem stem (62.12%). So DM content is higher in Neem stem (37.86%) than Moringa stem (8.98%). Ash content is slightly higher in Moringa stem (6.65%) than Neem stem (6.32%). CP content is higher in Moringa stem (10.5%) than Neem (5.28%). CF content of Neem stem (38.25%) is higher than Moringa stem (42.94%).

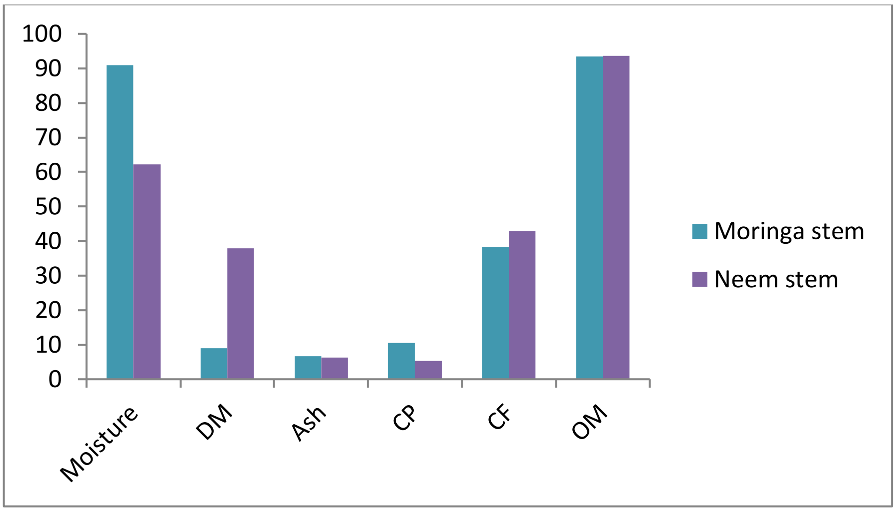

FIG 3. Comparison of chemical composition between Moringa and Neem stem

Chapter 5: Conclusion

Result shows that both *Azadirachta indica (*Neem*) and Moringa oleifera* contain adequate amount of DM%, CP%., CF% and Ash%. But *Moringa oleifera* contains more CP and OM than *Azadirachta indica* (Neem). DM content is quite higher in Neem leaf and foliage than Moringa. But in stem Neem content more DM. Ash content are quite similar in both plants. The plants are useful for both animal and human benefits. Both of them can be used in animal ration, medical sector, food sector and other field.

Chapter 6

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Biography

Intern Doctor, Veterinary Medicine

Chattogram Veterinary and Animal Sciences University

E-mail: paprychakrabortty@gmail.com

Personal Profile:

Name: Papry Chakrabortty

Father's Name: Joyanto Chakrabortty

Mother's Name: Protima Chakrabortty

Permanent Address: Gaibandha

Nationality: Bangladeshi

Religion: Hindu

Blood group: AB+

Academic Qualifications:

Name of the examination/ Course	Name of the institution	Board	Passing Year	Grade
SSC	Ahmed Uddin Shah School and Collage, Gaibandha	Dinajpur	2013	5.00
HSC	Ahmed Uddin Shah School and Collage, Gaibandha	Dinajpur	2015	5.00
DVM	Chattogram Veterinary and Animal Sciences University	CVASU	——	——