SUNTEXT REVIEWS

SunText Review of Medical & Clinical Research
ISSN: 2766-4813

Open Access
Research Article
Volume 3:2

Comparative Study of Nutritional Compounds and Microbial Analysis of Moringa Oleifera (Sajna Leaf) Powder in Different Drying Method during Storage Periods

Rajbongshi N[1], Khalek A[2], Rafia R[3], Miah S[3], Amin A[2], Ahmed S[3], Islam MS[1] and Hosen A[3,*]

1Department of Microbiology, Jagannath University, Dhaka, Bangladesh
2Department of Microbiology, Primeasia University, Dhaka, Bangladesh
3Department of Microbiology, Hajee Mohammad Danesh Science and Technology University Dinajpur, Bangladesh

***Corresponding author:** Hosen A, Department of Microbiology, Hajee Mohammad Danesh Science and Technology University Dinajpur, Bangladesh; Tel: +8801969125905; E-mail: aoulad1992@gmail.com

Received date: 31 March 2022; **Accepted date:** 04 April 2022; **Published date:** 10 April 2022

Citation: Rajbongshi N, Khalek A, Rafia R, Miah S, Amin A, Ahmed S, et al. (2022) Comparative Study of Nutritional Compounds and Microbial Analysis of Moringa Oleifera (Sajna Leaf) Powder in Different Drying Method during Storage Periods. SunText Rev Med Clin Res 3(2): 151.

DOI: https://doi.org/10.51737/2766-4813.2022.051

Abstract

Moringa oleifera leaves have nutritional and medicinal values that helps to prevent disease. The objective of present research was to investigate the nutritional value and microbiological evaluation of Moringa oleifera leaves powder during storage periods. In these research leaves were collected from Dhaka, savar, dhamrai, nabinagar, kaliakoir respectively. *Moringa oleifera* leaves were processed by using 3 different methods like as solar dried, mechanical drier and oven drier. Nutritional values (proximate analysis) including moisture, protein, ash, fat, carbohydrates and energy were measured by utilizing distinct methods and devices. This study found highest moisture content in solar drier at 4th month of storage *Moringa oleifera* powder. Moisture content of raw *Moringa oleifera* is 81.4% where gradually increased the moisture content during the storage periods. Three different methods including solar drier, mechanical drier and oven drier were used for measuring nutritional values. The result showed that in solar drier, moisture content was measured increasing during 4 month storage 3.93%, 4.06%, 4.11% and 4.52% where mechanical drier were 7.75%, 7.80%, 7.86%, 7.96% and oven drier 6.15%, 6.28%, 6.75% and 6.82%. Other proximate analysis also measured both three methods. Beside proximate analysis microbiological analysis also conducted in the storage periods. Highest number of coliform bacteria and fungus were identified in the last month of storage periods. Among three methods oven drier gives best results during preservation periods. *Moringa oleifera* leave could be used as antimicrobial medicine against commercial antibiotics and also cure different diseases such as diarrhea, high blood pressure, food poisoning etc.

Keywords: *Moringa oleifera*; Proximate analysis; Preservation

Introduction

Moringa oleifera is a perennial tree that belongs to the Moringaceae family and is yet underused. Drumstick, sahjan, and sohanjana are all names for the same plant. All plant components have a wide spectrum of functional and nutraceutical qualities, making this plant a versatile biomaterial for food and other applications [1]. The leaves, blooms, and fruits of this plant are utilized as a major food source to battle protein energy deficiency, which affects the majority of the world's developing and underdeveloped countries. Because of the presence of several types of antioxidant chemicals, this plant's leaves are very good origin of nutraceuticals and functions [2]. Flavonoids from plants are significant in the diet, and a high flavonoid consumption has been associated to a lower risk of cardiovascular disease, osteoporosis, and are other age related degenerative complication

[3-5]. The World Health Organization (WHO) has been studying M. oleifera's usage as a low-cost supplement enhancer in the world's poorest areas for decades (WHO Readers Forum, 1999). According to the United Nations Food and Agriculture Organization, one out of every twelve people in the world is malnourished, with 160 million children under the age of five falling into this category (United Nations Food and Agriculture Statistics, 2008). Herbal remedies are still widely utilized in many parts of the globe, particularly in places where modern treatments are unavailable [6]. Furthermore, scientific study to establish the biological activity of medicinal plants is needed in utmost African nations where verdant treatments are yet widely depended on due to the expense of chemotherapy treatments. The findings of this research might lead to the validation of historically used and medicinally important plants, allowing them to be fully utilized [7]. Moringa is a fast-growing plant that is commonly accessible in the tropics and subtropics and has a wide range of industrial and therapeutic applications. One of the most extensively farmed species is *Moringa oleifera*, an essential medical plant. Anti-tumour, antioxidant, anti-inflammatory/diuretic, antipathetic, hypertensive, hypocholesterolaemia, and hypoglycaemic properties have long been considered to exist in Moringa species [8].The roots, flowers, gum, and seeds are commonly used as anti-diabetics and to treat inflammation, heart disease, liver disease, and haematological, hepatic, and renal function. Moringa leaves, fruits, and seeds have been shown to be high in protein, important minerals (calcium, magnesium, potassium, and iron), and vitamins (vitamin A, C and E) [9]. Plants have recently acquired popularity as a source of new chemicals for treating microbial diseases. Because of the high cost, low effectiveness, and developing resistance to conventional treatment, the need for plant-based antimicrobial is becoming more urgent. Herbal medications are significant in primary health care in developing countries, particularly where access to health care is restricted. The moringa plant's natural medicine components have been shown to decrease tumor incidence in experimental mice [10]. This research helps to evaluate the nutritional value of *Moringa oleifera* during storage periods and microbiological analysis also were determined. In light of these considerations, the goal of this study was to evaluate the characteristics of *Moringa oleifera* leaf powder in order to expand its use as a functional food ingredient in food and pharmaceutical products of interest, as well as to promote this important but underutilized plant that is readily available in certain parts of the country in a shelf-stable, easily usable form to the general public.

Materials and Methods

This research work was completed at vegetable technology and Food microbiology, Institute of Food Science and Technology, Bangladesh Council of Scientific and Industrial Research, Dhaka-1205.

Sample collection area and processing

Fresh *Moringa oleifera* (sajna leaves) leaves were collected from the BCSIR campus, Savar, Dhamri and Fulbaria. The sajna leaves were then weighed and properly washed in clean water to remove any clinging soil or dead leaves, as well as to minimize the amount of infected microorganisms. Then, for up to 10 minutes, boil with 800°F water to destroy the enzymes in the food and to prevent unwanted texture changes. Then cooed and 0.1% sodium metabisulphite and were Kept into room temperature for 1 hours. Keep in polybag for further use (Figure 1).

Figure 1: *Raw Moringa oleifera leaves.*

Methods of nutrient analysis

The nutritional value of raw and powder product was determined by the following methods.
Determination of moisture content

Oven drying method

The moisture content of *Moringa oleifera* samples was measured using an oven dryer (Wised, Model-msh-30A) that comprises of a chamber in which trays of *Moringa oleifera* samples were put at a controlled temperature (65-75˚C) [11]. For three to four days, drying was started in the oven dryer for 6-7 hours. The amount of Moisture contents of samples can be calculated by the following procedure.

$$\% \text{ of moisture content} = \frac{W_1 - W_2 \times 100}{W_0}$$

W1 =Weight of (sample + basin) before being dried
W2= Weight of (sample + basin) after drying
W0 = Weight of sample

Mechanical drying method

The *Moringa oleifera* sample was dehydrated using a hot air flow mechanical drier (Wessberg & Tolander Pte. Ltd. Sydney, N.S.W No. 3571). The dryer is made up of a chamber where product trays are put. A fan blew air over the trays of items to be dried at 55-600°C, passing through a heater on the way. An anemometer

recorded (600ft/min) air velocity. The amount of drying was determined by weight loss. Finally make a smooth powder by using a grinder. The moisture content measured by resulting of weight loss.

Solar drying method

In this research a direct solar absorption method was applied. Moringa leaves were placed in the chamber. The heat vaporized the moisture from the leaves. The moisture content measured by resulting of weight loss.

Determination of Ash (Muffle Furnace)

Weight about 1-2 of sample and place in a pre-weigh crucible. The sample in a crucible was burned and transferred to a muffle furnace at 6000C for 4-6 hrs. Ash sample would be white to slightly grey when ashing was complete. Cool the crucible in desiccators to room temp and re-weight it. The ash content was calculated as:

$$\% \text{ Ash content} = \frac{W_1 - W_2 \times 100}{W_o}$$

Where,

W_1= weight of the empty crucible

W_2= weight of the crucible + dried sample

W_o= weight of sample

Protein determination analysis (Micro-Kjeldahl method)

Digestion

About 0.5 gm of sample was taken on a ash less filter paper. The sample was transferred to a long neck kjeldhal flask. Small amount (0.2-0.25 gm) of digestion mixture and 20ml of conc. H2SO4 was added to the flask and 2 chips were taken in each flask. Heat the flask over a low flame until the first foaming stops and the liquid boils vigorously at a moderate rate. Heat for 60 minutes or until the digest is pale blue in colour. Then cool and transfer the digest to a volumetric flask (100ml). Then rinse the digestion flask 2 or 3 times with water, cool and make 100 volumes with water.

Distillation and titration

Heated and wash the kjeldhal apparatus with distilled water. 10ml of 2% boric acid solution was taken in each 100 ml conical flask and add few drops of mixed indicator which was placed at narrow tube of kjeldhal apparatus. The tube should be must dipped into boric acid solution. Introduce 10ml of digestion sample, few drops of phenolphthalein and 10ml of concentration NaOH through the funnel of kjeldhal apparatus. Stirs up the digestion mixture and NaOH and librates ammonia which passes through the condenser and into the boric acid solution as steam. The distilled solution was collected in 100ml conical flask containing boric acid. After collecting 50ml, the machine was stopped and the conical flask was removed from the apparatus. The collected sample from the kjeldhal apparatus was titrated against 0.01N HCL until color became pink.

Calculation: By using following equation % of nitrogen was calculated

$$\text{Nitrogen}\% = \frac{(S-B)\times N\times V\times 100}{A\times W\times 1000}$$

Where,

S= Titration reading for sample

B= Titration reading for blank

N= Normality of HCL

V= Volume made up the digest

A= Aliquot of the digest taken

W= Weight of the sample

% of protein = % of N2×6.25

Note: 6.25 is the crude protein factor

Determination of Fat (Soxhlet apparatus method)

Soxhlet extraction method was used for the determination of fat. Take 5 gm of sample in a filter paper bag (Thimble). In the Soxhlet device, place the thimble in the fat extraction tube. Then connect the extraction tubes bottom to a Soxhlet flask. Load the correct amount of petroleum ether into the flask through the sample in the tube. Then connect the condenser to the fat extraction tube and then place in a water bath. Remove the thimble from the device and distil the majority of the ether. Pour the ether into a small, dry (already weighed) beaker after it has achieved a modest volume. Using numerous tiny portions of ether, rinse and filter the flask completely. On a low heat steam bath, evaporate the ether. Dry at 1000C for 1hr, cool and weigh. The whole process need 8-9 hrs for complete extraction.

Calculation:

$$\% \text{ Fat content} = \frac{W_1 - W2\times 100}{W_o}$$

Here

W_2=Wt of beaker+fat

W_1=Wt of beaker

W_o =Wt of sample.

Determination of Carbohydrate content (by difference method)

Calculation: Carbohydrate= 100-(moisture+ ash+ protein+ fat+ crude fiber)

Determination of energy

Calculation: Energy= (protein×4.1) + (fat × 9.3) + (carbohydrate×4.1)

Methods for microbiological analysis

Three methods such as pour plate, spread plate and MPN method were used for enumeration of bacteria and fungus in this research. Serial dilution preparation for pour plate and spread plate was done followed by proper serial dilution method. 1gm sajna leaf powder was mixed into 90 ml peptone water then 1 ml sample poured into petrifies and poured media on it and spread. Then incubate overnight for bacterial growth. A 0.2ml sample was put onto a solidified agar plate on a potato dextrose agar (PDA) plate, and the sample was distributed over the agar plate with the assistance of a sterilized bent glass rod (spreader). There were 5 petriplates for each sample in this study. Yeast and mould counts were determined by using above two methods [12].

MPN method was used to enumeration of total coliform bacteria. McCrady (1915), Halvorson, and Zieger (1933) reported the first precise estimate of the number of live bacteria using the MPN technique.

Results

Moringa oleifera leaves were found to be high in proteins and carbohydrates, but low in crude fat, fiber, and ash, according to these research.

Nutritional composition of raw moringa olifera leaves

Nutritional composition of raw moringa olifera leaves are presented in the following (Table 1).

Table 1: *The chemical compositon of raw Moringa oleifera.*

Moisture (%)	Protein (%)	Fat (%)	Fiber (%)	Ash (%)	Carbohydrate (%)	Energy
81.65	8.20	2.34	1.70	2.40	3.71	70.593

Table 2: *Effect of storage on solar dried Moringa oleifera leaves powder.*

Month	Moisture	Protein	Fat	Fiber	Ash	Carbohydrate	Energy
1st	3.93	15.96	9.63	8.23	2.40	59.85	400.38
2nd	4.06	17.97	6.84	5.42	6.86	58.85	378.57
3rd	4.11	22.90	7.23	8.16	8.69	48.91	361.66
4th	4.52	19.49	9.69	9.73	7.78	48.79	370.06

Table 3: *Effect of storage on Mechanical dried Moringa oleifera leaves powder.*

Month	Moisture	Protein	Fat	Fiber	Ash	Carbohydrate	Energy
1st	7.75	34.21	3.05	6.72	6.52	58.25	407.45
2nd	7.19	36.11	6.99	5.40	6.81	37.50	366.80
3rd	7.86	34.31	10.70	14.19	8.32	24.62	341.12
4th	7.96	30.18	7.94	10.11	7.57	36.24	346.16

Table 4: *Effect of storage on oven dried Moringa oleifera leaves powder.*

Month	Moisture	Protein	Fat	Fiber	Ash	Carbohydrate	Energy
1st	6.15	27.12	3.33	6.63	7.53	49.24	344.04
2nd	6.28	26.14	6.40	5.48	7.45	51.75	378.86
3rd	6.75	24.96	9.57	11.30	7.45	39.97	355.20
4th	6.82	24.17	10.35	11.89	7.45	39.32	356.56

Nutritional composition of powdered product (Based on Different drying methods)

All data were analyzed four times for four month to know the time of retention of nutrient of the powder form of *Moringa oleifera* leaves. The data for nutritional composition of solar drying, mechanical drying and oven drying product were mentioned in table 2, 3 and 4. The observation of powdered product in different month influenced some of the characteristics of nutritional composition. It was the effect of dehydration which can vary in month to month observation (Table 2).

Above table (2) shown that the gradual increase of moisture ,with the decrease of protein, fat, fiber, ash, carbohydrate, energy content of leaves powder. When it was freshly prepared the moisture content was (81.65%). After month to month observation, the moisture contents were decreased and nutrient contents were increased from the observation of raw material. For the solar dried *Moringa oleifera* leaves powder, the moisture contents were increased and the other nutrient contents were slightly decreased from the month to month observation (Table 3,4).

From the four month observation, we can see that some of the nutritional composition were increased in month to month duration and some of the composition were decreased in month to month duration and some of them were fluctuated in month to month duration. This result can variate by the effect of dehydration on the nutritional composition.

Result of the total bacterial count

In these research plate count agar (PCA) media were used to calculate the bacterial count from dried moringa leaves powder. This study represent different bacterial load in preserved moringa leaves powder. Bacterial count of this study was done by two categorized like as direct counting from dried sample and count from 10-3 dilution. In the first month, absence of growth in 10-3 dilution of all sample and presence of growth in others plates where the sample was directly taken from the dried leaves. In solar dried gradually increased the bacterial counts and after 4 month TNTC found in 10-3 dilution. In mechanical drier bacterial count found TNTC after 4th month where oven dried moringa leaves powder found no growth up to 3rd month of preservation. The total viable bacterial count of samples are shown in below (Table 5).

Result of the total fungal count

PDA agar media was used for the fungal count of this study by the spread plate methods. In the first and second month absence of growth of fungus in most of the sample and presence of growth of all sample in third and fourth month. Among 3 method oven dried method gives good result.The results are presented in the below Table 6 and Figure 2 (Table 6).

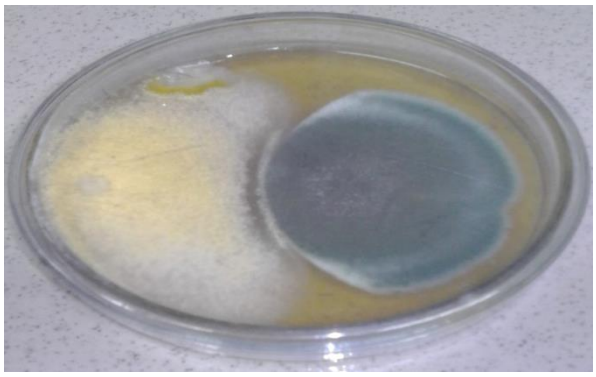

Figure 2: *PCA plate with bacterial growth.*

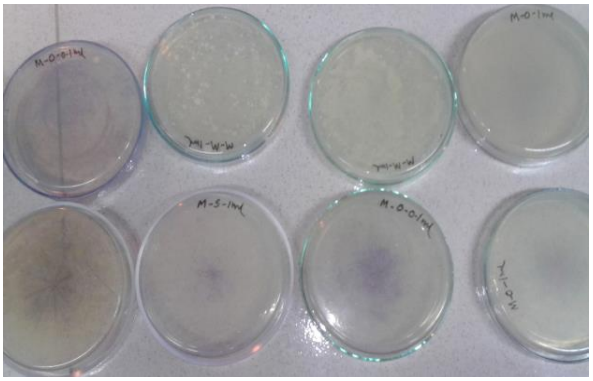

Figure 3*: PDA plate with fungal growth.*

Figure 4: *LST media with coliform growth.*

Result of the enumeration of total coliform

LST (Laurly Tryptose Sulfate Broth) media by MPN (Most probable Number) three tube method was used for total coliform count and EMB (Eiosin methylene blue) was used to see the fecal contamination. The total coliform count of the samples are shown in Table 7, Figure 3 and 4 .This total coliform counting sample was directly taken from the dried leaves. In the first month observation, absence of coliform and in the second, third and

fourth month observation, presence of coliform in all sampling plate (Table 7) (Figure 2-5).

Figure 5: *Growth of coliform bacteria on EMB plate.*

Discussion

Moringa olifera dried powder is very much important now a days in heath sectors. There are so many medicinal value and nutritional value present in dried powder which is helpful for public health. Moringa leaves powder uses as natural products treatment against more than 300 diseases in recent time over the world. In this present study processed powder products were stored in room temperature (25-30˚C). The nutritional and microbiological quality of the dried leaves powder were assessed after 6 months of storage. The quality of the processed product was found to be different from that of newly processed products even after one month of storage. The quality of the first month's product was superior to the previous items. It began to degrade after four months of storage and rapidly worsened after five months. The major cause of product degradation was excessive moisture and ascorbic acid levels. As a result, chemical preservatives that are not hazardous to human health should be applied at the required amount allowed by Bangladesh Standard and Testing Institute to extend the shelf-life of processed items. Leaves (84–86%), stems (14–15.5%), and miscellaneous materials were consistently present in Moringa samples (0.25% to 0.40 %).

Table 5: *Bacterial count observation of moringa leaves powder on PCA plate.*

Month	Solar Drier		Mechanical Drier		Oven Drier	
	Fresh Powder	**10-3 dilutation**	**Fresh Powder**	**10-3 dilutation**	**Fresh Powder**	**10-3 dilutation**
1st	32 cfu/g	No growth	14 cfu/g	No growth	56 cfu/g	No growth
2nd	43 cfu/g	No growth	TNTC	TNTC	24 cfu/g	No growth
3rd	73 cfu/g	No growth	144 cfu/g	164×10^3 cfu/g	16 cfu/g	No growth
4th	169 cfu/g	TNTC	TNTC	TNTC	26 cfu/g	60×10^3 cfu/g

Table 6: *Fungal count observation of moringa leaves powder on PDA plate.*

Month	Solar Drier	Mechanical Drier	Oven Drier
	Moringa leaves powder	**Moringa leaves powder**	**Moringa leaves powder**
1st	Growth positive	No Growth	No Growth
2nd	Growth	No Growth	No Growth
3rd	Growth	Growth	No Growth
4th	Growth	Growth	No Growth

Table 7: *Coliform count observation of moringa leaves powder on EMB plate.*

Month	Solar Drier	Mechanical Drier	Oven Drier
	Leaves Powder	**Leaves Powder**	**Leaves Powder**
1st	No Growth	No growth	No growth
2nd	Coliform presence	Coliform presence	No growth

3rd	Coliform presence	Coliform presence	Coliform presence
4th	Coliform presence	Coliform presence	Coliform presence

The analytical approach was developed based on previous moringa research [13]. The moisture content of the aforementioned samples ranged from 3.9 to 7.96%, with the lowest and highest readings being 3.9 and 7.96%, respectively. These findings imply that the leaves were dried for variable amounts of time and gathered from various plants. Other samples, which were within the necessary moisture percentage of less than 10%, showed a consistent connection. Because the overall ashes were found to be at a high percentage, the ash content showed that the leaves do contain minerals. The quantity of sand, dirt, or unknown environmental factors that might impact the leaves in question was assessed by the insoluble ashes content, which was less than 1%. The absence of these values in our analysis suggested that the leaves were not polluted and were relatively clean. Other nutritional value such as Protein, Fat, Fiber, Carbohydrate and Energy were an average level. From the four month observation of microbial activities, microbial load were not present in the first month were but it increased in month to month duration. The mechanical dried sample were higher microbial load than other sample. May be contamination were present in the mechanical dried sample. Microbial load were more present in the last month products. Among three drying method oven drying method gave best preservation techniques. This research try to evaluate the nutritional value and microbiological analysis during the storage periods of moringa leaves extract at different region in Bangladesh. In future we want to apply this powder products against different disease as natural treatment such as diabetics, high blood pressure and so on.

Conclusion

Moringa oleifera is a natural medicine which is applied for the treatment of many disease caused by pathogenic bacteria. Moringa leaves have good nutrient sources and also have microbial activity against pathogenic organisms. Moringa leaves extract are very much helpful for pregnant women. As a natural medicine diarrhoea, tumors, hypertension, diabetes, stomach ulcer, gastrointestinal disorder are treated by Moringa oleifera leaves extract. This research indicates that different nutritional value found in different areas this is due to differences in climate change, plant age, soil, and processing techniques. Proper preservation and appropriate uses of leaves powder is most important.

Acknowledgement

The authors would like to thank Institute of Food Science and Technology, Bangladesh Council of Scientific and Industrial Research. The authors also wants to special thanks to the personnel who were involved in laboratory analysis.

Conflict of Interests

The authors have no conflict of interest.

References

1. Singh Y, Prasad K. Moringa Oleifera leaf as functional food powder. Charact Uses. 2013; 4: 317-324.
2. Anwar F, Latif S, Ashraf M, Gilani AH. Moringa oleifera: a food plant with multiple medicinal uses. Phytotherapy Research: An Int J Devoted Pharmacological Toxicological Evaluation Natural Product Derivatives. 2007; 21: 17-25.
3. Middleton E, Kandaswami C, Theoharides TC. The effects of plant flavonoids on mammalian cells: implications for inflammation, heart disease, and cancer. Pharmacological reviews. 2000; 52: 673-751.
4. Havsteen BH. The biochemistry and medical significance of the flavonoids. Pharmacol therapeutics. 2002; 96: 67-202.
5. Morris ME, Zhang S. Flavonoid–drug interactions: effects of flavonoids on ABC transporters. Life sci. 2006; 78: 2116-2130.
6. Ajibade LT, Fatoba PO, Raheem UA, Odunuga BA. Ethnomedicine and primary healthcare in Ilorin, Nigeria. Indian J Traditional Knowledge. 2005; 4: 150-158.
7. Mensah IA. Towards a rational scientific basis for herbal medicine. Ghana Universities Press. 1992.
8. Sreelatha S, Padma PR. Antioxidant activity and total phenolic content of Moringa oleifera leaves in two stages of maturity. Plant foods human nutrition. 2009; 64: 303-311.
9. Fuglie LJ. The miracle tree: Moringa oleifera, natural nutrition for the tropics. 1999.
10. Bharali R, Tabassum J, Azad MR. Chemomodulatory effect of Moringa oleifera, Lam, on hepatic carcinogen metabolising enzymes, antioxidant parameters and skin papillomagenesis in mice. Asian Pacific J Cancer Prevention. 2003; 4: 131-140.
11. Akter M, Roshid M, Hosen MA, Hosain M, Islam M, Khalek MA, et al. Physico-chemical and sensory properties of cakes supplemented with different concentration of soy flour. Int J Food Sci Nutrition. 2021; 6: 16-21.
12. McBurney RP, Griffin C, Paul AA, Greenberg DC. The nutritional composition of African wild food plants: from compilation to utilization. J Food Composition Analysis. 2004; 17: 277-289.
13. Dahiru D, Onubiyi JA, Umaru HA. Phytochemical screening and antiulcerogenic effect of Moringa oleifera aqueous leaf extract. African J Traditional, Complementary Alternative Med. 2006; 3: 70-75.