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# Effect of substituting wheat flour with buckwheat, honeyweed and stevia on nutritional and organoleptic properties of biscuit

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**Abstract**
Low calorie and high fiber content biscuits have greater demand than other types of biscuits among the biscuit consumers. Therefore, composite biscuits were prepared incorporating different levels of buckwheat flour and constant amount of honeyweed and stevia powder with wheat flour. The influence of partial replacement of wheat flour by above stated ingredients on the nutritional and sensory characteristics of three types of biscuit samples were analyzed. Fat and ash content were found to be increased significantly with the increased amount of buckwheat incorporation but protein content decreased with increased buckwheat incorporation level (p 0.05). However fiber content was also increased gradually with increased level of incorporation. The sensory result revealed that biscuits color and taste scores had decreased significantly with the increased level of buckwheat flour incorporation. Texture score was also decreased with buckwheat incorporation level but not significantly as other parameters. However, on a nine-point sensory scale, the overall acceptability of biscuit samples was above 7, suggesting the noticeable consumer satisfaction.

**Keywords:** honeyweed, buckwheat, stevia, biscuit, fiber content

## 1. Introduction
Preparation of fortified biscuit with different ingredients is important as it possesses high nutritional, functional and medicinal values. It is one of the most widely consumed ready to eat snacks due to its longer shelf life because of low moisture content(Manley,1998) [1]. It is easy to carry and has good eating quality (Akubor, 2003; Hooda and Jood, 2005) [2, 3]. Biscuits are generally rich in carbohydrate, fats and calories and lack of dietary fiber, vitamins, minerals and phenolic compounds. Numerous underutilized pseudo-cereals, weeds and natural sweetener containing high medicinal value can be incorporated to biscuits to draw consumers acceptance in terms of ingestion and nutritional requirements.

Honeyweed **(***Leonurus sibiricus***)** is an annual, biannual or perennial, herbaceous and aromatic plant that is grown in many countries in Asia and South America(Ahmed *et. al*., 2006; Sayed *et. al*., 2016; Rahmatullah *et. al*., 2010; Narukawa *et. al*., 2014) [4,5,6,7]. This plant belongs to the Lamiaceae family. L. sibiricus which is familiar as different name in different countries such as honeyweed or Siberian motherwort in English, Roktodrone in Bengali, Guma in Hindi.The average height of this plant is 40–120 cm and germinates from seed. Lamiaceae family consists of about 236 genera and 6900–7200 species. Among all the genera, Leonurus contains about 20 species (Tasdemir *et. al*., 1995) [8] and L. sibiricus is one of them. This plant has been used as medicinal raw material and culinary ingredients from ancient time (Chua *et. al*., 2005) [9]. It is used to treat against diabetes (Type II), menstrual irregularities, hemorrhage, hypertension, inflammation and bronchitis.

Buckwheat (Fagopyrum esculentum) is a gluten free pseudocereal annual crop. It is also known as beech wheat, Japanese buckwheat and Silverhull buckwheat. The physical and chemical characteristics of buckwheat grain are fairly different from those of wheat grain (H.G. Marshall, 1982) [10]. This grains contain abundant nutritional compounds (Li, S. and Zhang, 2001) [11]. Especially, they are rich in B vitamins (Fabjan *et. al*., 2003) [12], protein, fiber, starch and prevalence of unsaturated fatty acid like C18:1, C18:2, C18:3 and C20:1 (Bonafaccia and Kreft., 2003) [13]. Buckwheat flour (BWF) is richer in lysine, iron, copper and magnesium content than wheat flour (Ikeda and Yamashita, 1994) [14]. Whole buckwheat possess about 2-5 times more phenolic constituents than that of oats or barely. On the contrary, buckwheat bran and hull demonstrates almost 2-7 times greater antioxidant activity than barley, triticale and oats] (Holasova *et. al*., 2002 and Zdunczyk *et. al*., 2006) [15, 16]. The substantial contents of rutin, catechins, other polyphenols and their antioxidant activity have great significance (Oomah and Mazza, 1996; Wanatabe, 1998). [17, 18]. These functional constituents of buckwheat are beneficial for health like reducing high blood pressure, lowering cholesterol, controlling blood sugar and preventing cancer risk(Fabjan *et. al*., 2003;) [13]. Buckwheat flour incorporation in biscuit preparation has been observed to show significant effect in biscuit quality in terms of sensory and nutritional aspects (Baljeet *et. al*., 2010 and Ulfat *et. al*., 2015) [19, 20].

Stevia (*Stevia rebaudian*) is a herbaceous perennial plant refers to the Asteraceae family. Leaves of this plant produce zero-calorie ent-kaurene diterpene glycosides (*stevioside*

and *rebaudiosides*), a non-nutritive, pH-stable, heat-stable, not fermentable (Abdullateef and Osman, 2012) [21], high-potency sweetener, and substitute to sucrose, being 300 times sweeter than sucrose (B. Ahmed *et. al*., 2011) [22]. Though genus Stevia contains around 240 species but only S. rebaudiana offers the sweetest essence (Savita *et. al*., 2004) [23].It is a shrub that grows about one meter and has 2-3 cm long oval leaves which are green, having no odor and tastes sweet. The major components of stevia were reported in dry basis as stevioside 5-10%, rebaudinoside A 2-4%, rebaudinoside C 1-2% and dulcoside 0.4-0.7% (Wood *et. al*., 1955) [24] .Stevioside and its constituents including rebaudioside A and steviol offer many health benefits which include antihypertensive, antidiabetic, anti-inflammatory, anti-tumor, antioxidant, antidiarrheal, diuretic and immunomodulatory actions (Goyal *et. al*., 2010, and Boonkaewwan *et. al*., 2008) [25, 26]. S. rebaudiana is commonly used for the treatment of various health diseases such as cancer (Yasukawa et al. 2002) [27], diabetes (Lailerd *et. al*., 2004) [28], obesity, cavities, hypertension (Dyrskog *et. al*., 2005) [29], fatigue, depression, and yeast infection. Toxicology studies have been observed that stevia doesn't show any teratogenic or carcinogenic effects and no allergic reactions when it is consumed as sweetener (Pol *et. al*., 2007) [30]. Japanese have been using stevia and its processed products such as cooked or baked product, tobacco products, beverage preparation, confectionary product like chewing gum and many more (Brandle, 1992) [31].

Wheat is one of the most substantial crops around the world which excels all other cereal crops in terms of area and crop. That's why it is considered as king of all cereals (*et. al*., 2013) [32]. It's belongs to Poaceae family and Triticum genera. Among all the species of wheat Triticum aestivum is known as common wheat. Its flour contains around 70-75% starch, 12-14% water, 10-12% protein, lipid 2%, 2-3% non-starch polysaccharides, few amounts of vitamins and particular arabinoxylans (AX) (Goesaert *et. al*., 2005) [33]. Wheat possesses a special type of protein known as gluten which creates viscoelastic property upon hydration. This property is the major reason for using wheat flour as a main ingredient for biscuit, noodles, cake, pasta, macaroni, spaghetti and other bakery purposes (Baljeet *et. al*., 2010, Garcia *et. al*., 2014, Ariful *et. al*., 2014, Amit *et. al*., 2011, and Azza *et. al*., 2016) [19, 34, 35, 36, 37]. Various researches indicate that whole wheat food may associate with lowering the risk of coronary heart diseases and definite types of cancers (Trushwell *et. al*., 2002 and Zoran *et. al*., 1997) [38, 39]. It is containing a number of phenolic acids, antioxidants, and polyphenols (Halliwell *et. al*., 1990, Mpofu *et. al*., 2006) [40, 41] which have greater significance on different health concerns.

In Bangladesh prospective, wheat is being extensively used in different food processing industry such as bakery industry, extraction industry such as gluten extraction industry, analytical industry etc. Till date, honeyweed, buckwheat, stevia are not found to be used as food ingredient especially in biscuit preparation although these plants have high medicinal impact on various health issues. Keeping in view on proximate composition including the functional and nutritional properties of wheat, stevia, buckwheat and honeyweed, this present study was undertaken with the following objectives.

- To develop biscuit from buckwheat and wheat flour with incorporation of honey weed and stevia.
- To analyze proximate composition of the developed products.
- To measure acceptability of the prepared products by sensory evaluation.

## 2. Materials and methods

### 2.1 Experimental site

This work was conducted mostly in Food Engineering and Technology Laboratory, Food Processing and Preservation Laboratory and Food Science and Nutrition Laboratory under the Faculty of Engineering at Hajee Mohammad Danesh Science and Technology University. Some proximate analysis was also accomplished in the laboratories under the Department of Agricultural Chemistry of that University.

### 2.2 Materials collection

Buckwheat kernels were collected from local market of Panchagour, Bangladesh and stored at ambient condition until use. Then the grain was milled in a small capacity local flour mill. Stevia (natural zero calorie sweetener) was procured from Midfort, Dhaka. Honeyweed was collected from local area at Dinajpur, and other materials such as refined wheat flour, vegetable oil, dalda, egg and vanilla were also purchased from local market of Dinajpur. Necessary equipment and chemicals of analytical grade were supplied from the above mentioned laboratories.

### 2.3 Preparation of ingredients

#### 2.3.1 Milling and sieving of buckwheat kernel

Fine buckwheat flour was separated from husk and sieved at 140 meshes. (Fig 1).

**Fig 1:** Buckwheat flour

#### 2.3.2 Washing, drying and grinding of honeyweed

Collected honeyweed was properly cleaned through running water with rubbing the surface by hand. After that sun drying method was followed to dry the sample. These dried leave were then grinded by a grinder (Jaipan, JP-3501, India) and sieved at 140 mesh. (Fig 2-A, B, C).

A) Honeyweed plant

B) Dry honeyweed leaf

C) Honeyweed powder

**Fig 2:** Photographic views of honeyweed in various stage of processing

### 2.4 Proportioning of the ingredients

Biscuits formulation was performed on the basis of results obtained from several trial and errors. Different formulations were used by earlier researchers for biscuits preparation. (Baljeet *et. al*., 2010) [19]. They prepared biscuit with 10%, 20%, 30%, 40% buckwheat flour incorporation with wheat flour. Based on previous research and present trials, three different formulations namely sample-1, sample-2, sample-3 were used for the preparation of biscuit for investigation. In the formulation amount of honeyweed and stevia were kept constant. The amounts of ingredients shows in (Table 1)

**Table 1:** Proportioning of ingredients for three different samples

| Ingredients | Sample 1 (gm) | Sample 2 (gm) | Sample 3 (gm) |
|---|---|---|---|
| Buckwheat Flour | 15 | 20 | 25 |
| Wheat Flour | 35 | 30 | 25 |
| Honeyweed | 1.5 | 1.5 | 1.5 |
| Stevia | 3 | 3 | 3 |
| Shortening agent | 20 | 20 | 20 |
| Baking Powder | 0.5 | 0.5 | 0.5 |
| Salt | 1 | 1 | 1 |
| Essence | As required | As required | As required |

### 2.5 Preparation of biscuit samples

First, stevia was blended to get fine powder. Egg white from egg was taken in a bowl and blended with vegetable oil (dalda) by automatic mixer machine. All dry ingredients such as wheat flour, buckwheat, honeyweed, icing stevia and salt were weighed and mixed by blender. Dry ingredients, shortening and few drops essence were mixed and kneaded to get the crumbly dough. Same procedure was followed for preparing other samples.

The dough was then shaped and cut into desirable size and shape as shown in figure 3.5. After that a metal tray was pre heated at $160^0$C for 15 minutes in baking oven. Then the tray was brushed with soybean oil and placed the raw biscuits on it. The tray was placed into the pre heated oven at $160^0$C for 15 minutes. After 15 min the tray was kept out from oven to turn over the biscuit sample. The tray was then again left for baking at 160°C for 10 minutes. The baked biscuit were taken out from oven and cooled for 15 min. (Fig 3-A, B, C, D)

(A) Shaping of dough

(B) Baking of biscuit Samples

(C) Turnover of partial baked Biscuit

(D) Finished biscuit Samples

**Fig 3:** Biscuit preparation steps

**2.6 Proximate analysis of developed biscuits**

The following proximate analysis was performed as stated below in this section. However, few proximate analyses were not possible due to lack of lab facilities and other constraints.

**2.6.1 Determination of moisture content**

Moisture content was determined by oven drying method (AOAC, 2005). An empty crucible was washed, dried, cooled and weighed. Then definite quantity (5gm) of biscuit sample was taken in the crucible and was weighed. The crucible was placed in the oven and was dried at a temperature of $105^0$C for overnight. After drying the crucible was removed from the oven and cooled in desiccators and then weighed. Crucible with sample was again placed in the oven and dried for 30 minutes, then taken out from the oven, cooled in desiccators and weighed. Drying, cooling and weighing were repeated until two consecutive weights were same. Same procedure was followed for all samples.

For accuracy three replications were performed for each sample and mean moisture content was then calculated as follows:

$$\% \text{ Moisture content(wb)} = \frac{\text{Initial weight of sample} - \text{Bone dry weight of sample}}{\text{Initial weight of sample}} \times 100$$

**2.6.2 Determination of ash content**

Ash content of food stuff represents remaining inorganic residue (mostly mineral) after complete oxidation of organic matter. The total ash content of the sample was determined by AOAC, 2000 method. The oven dried biscuit sample was taken in a crucible and left inside muffle furnace 550°C for 6 hrs. The muffle furnace was turned off and waited till the temperature dropped at least 250°C, carefully opened the door and transferred the crucible to a desiccator to avoid losing ash and gain of moisture. After cooling the weight of crucible was recorded. The difference between the weight of oven dried matter and final weight represented the ash content of biscuit, which was expressed in percentage. It was calculated by using the following formula

$$\% \text{ Ash content} = \frac{\text{weight of ash}}{\text{Initial weight of oven dried sample}} \times 100$$

**2.6.3 Determination of protein content**

AOAC method 6.25 (2006) was used to determine the protein content of biscuit. Usually three stages are used to determine protein content. These stages are given below:

**A. Digestion**

1g previously oven dried sample was taken in a digestion flask .10g potassium sulphate ($K_2SO_4$ ), 0.1g copper sulphate ($CuSO_4$ ),1g selenium powder and 25ml conc.$H_2SO_4$ was added to it and heated until the solution became clear. Then the flask was cooled for 20 minutes at room temperature.

**B. Distillation**

After digestion about 300ml distilled water and 125ml 40% NaOH solution was added to it. Then the flask was attached quickly to the distillation set and heated the flask continuously. In the meantime a 250ml conical flask (containing 25ml of 4% boric acid and 4-5 drops of mixed indicator) was placed at the zet of the condenser.

**C. Titration**

About 150 ml distillate was collected and was titrated with 0.2 N $H_2SO_4$ solutions. The end point was indicated by orange color.

**D. Calculation**

$$\% \text{ Nitrogen} = \frac{\text{Titrate value} \times \text{N} \times 0.014 \times 100}{\text{Weight of sample (g)}}$$

% Protein = %Nitrogen × 6.25

Here 0.014 = miliequivalent weight of $N_2$

**2.6.4 Determination of crude fiber content**

The method is based on the procedure developed by Hennaberg, Stohman and Rautenberg in the agricultural experiment station at Weendebei Gottinger in Germany in 1864.

**A. Reagents**

a). 1.25% sulfuric acid solution: 12.5ml conc. sulfuric was added in about 200ml distilled water and the volume was made up to the 1000ml.

b).1.25% sodium hydroxide solution: 12.5g sodium hydroxide was dissolved in about 200ml distilled water and the volume was made up to the 1000ml.

**B. Procedure**

About 20g moisture and fat free sample was taken in a 500ml beaker, about 200ml 1.25% sulfuric acid was added in the beaker and boiled for 30 min. Keeping the volume constant by addition of distilled water at the frequent intervals. Then the mixture was filtered through a muslin cloth and the residue was washed with hot water till free from acid. Then the materials was transferred in the same beaker and about 200ml 1.25% NaOH solution was added in the beaker and boiled for 30 min.(Keeping the volume constant as before ). Then the mixture was filtered through same cloth. The residue was washed with hot water till free from alkali. Then the residue was transferred in a dried crucible (which previously was weighed) and dried about 24 hrs at 100-$105^0$C in an oven. Then the crucible cooled in desiccators and weighed the crucible. Then the crucible heated in a muffle furnace at $600^0$C for 3-5 hrs. Then the crucible was cooled and weighed again.

**C. Calculation**

$$\%\text{Crude fiber} = \frac{\text{Lose of weight}}{\text{Weight of sample}} \text{ x } 100$$

Loss of weight = (weight of sample after washing and drying – weight of ash)

**2.6.5 Determination of fat content**

Crude fat content of the sample was determined by using AOAC method (2000). The dried sample (1g) was weighed into fat free extraction thimble and plug lightly with cotton wool. The thimble was placed in the extractor and fitted up with reflux condenser and a 250 ml soxhlet flask which has

been previously dried in the oven, cooled in the desiccator and weighed. The soxhlet flask was then filled to $^{3}/_{4}$ of it volume with petroleum ether (boiling point 40-60°C) and the soxhlet flask extractor plus condenser set was placed on the heater. The heater was put on for six hours with constant running water from the tap for condensation of ether vapour. The set was constantly watched for ether leaks and the heat sources are adjusted appropriately for the ether to boil gently. The ether was left to siphon over several times at least 10-12 times until it was short of siphoning. The thimble-containing sample was then removed and dried on a clock glass on the bench top. The extractor flask with condenser was replaced and the distillation continues until the flask was practically dried. The flask which contained the fat or oil was detached, its exterior cleaned and dried to a constant weight in the oven.

$$\text{Percentage of fat} = \frac{W_1 - W_o}{\text{weight of sample taken}} \times 100$$

### 2.6.6 Determination of carbohydrate content

Total carbohydrate content of any food product has been calculated by difference method for many years rather than analyzed directly. So considering that fact carbohydrate content of the developed biscuit samples were determined by subtracting the measured protein, fat, fiber, ash and moisture from 100.

$$\text{Percentage of carbohydrate} = 100 - \%(\text{protein} + \text{fat} + \text{fiber} + \text{moisture} + \text{ash})$$

### 2.7 Organoleptic quality assessment (Sensory evaluation)

The sensory evaluation of prepared biscuit was carried out by a 20 semi-trained member panel. The panel members were requested to evaluate the quality attributes of biscuit in terms of appearance, texture, taste and overall acceptability. Their judgments were recorded in hedonic rating scores which vary between 0-9 that means dislike extremely to like extremely.

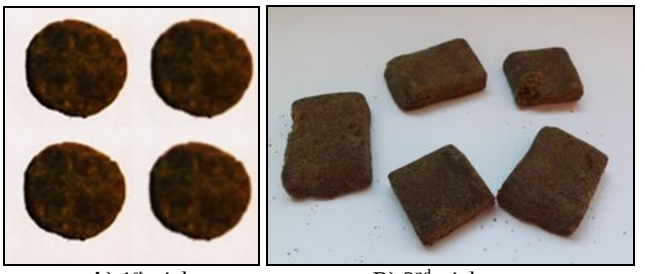
### 2.8 Statistical analysis

Single factor complete randomized design was employed to know the effect of incorporation of honeyweed, buckwheat, stevia with wheat flour on proximate composition and sensory attributes. Each experiment was replicated three times. The only factor was the biscuit formulation which had three different levels. Data were analyzed for obtaining mean, standard deviation, standard error and analysis of variance (ANOVA) using the SPSS software (V-22, IBM, 2013). However Duncan multiple range test (DMRT) was used to test the effect of different level proportioning to the proximate composition and sensory quality of developed biscuits.

## 3. Result and Discussion

### 3.1 Successful preparation of biscuits

Fig 4 represents the final product development after several trial and errors. The final attractive composite biscuits in terms of color, texture were developed successfully.



A) 1st trial B) 2nd trial

C) 3rd trial D) Final product

**Fig 4:** Various types of biscuit of trial preparation

### 3.2 Evaluation of composition of biscuits

### 3.2.1 Moisture content

The changes in moisture content (wet basis) of the three samples are summarized as wet basis in Fig 4.2.1. From fig 4.2.1 it is shown that mean moisture content of the developed biscuits sample was 1.65±0.01, 2.33±0.04, 2.26±0.01 respectively. In another research (Baljeet *et. al*., 2010) [19], concluded that the average moisture content of buckwheat biscuit ranges between 2.43±0.22 to 3.37±0.20% when buckwheat flour incorporated with wheat flour within the range of 10 to 40%. The possible causes for the deviation of results might be due to the incorporation of different proportioned honeyweed and stevia for biscuit preparation or might be the temperature and time variation during baking process. (Fig 5)

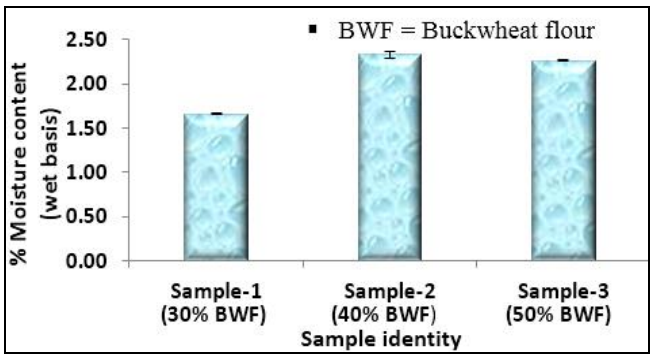



**Fig 5:** Effect of various ingredients incorporation on moisture content of composite biscuits

### 3.2.2 Ash content

The mean ash content was found 1.63±0.03, 1.98±0.01,

1.76±0.02 for sample-1, sample-2 and sample-3 respectively. (Baljeet *et. al*., 2010) [21], found that the ash content of buckwheat biscuit varies between 0.54±0.02 to 0.67±0.01% when the incorporation of buckwheat takes place within the range of 10-40% with wheat flour. Present study indicates much higher value than the previous study. The possible reason for the elevated ash content might be the incorporation of honeyweed and stevia which are rich in mineral content (Atteh *et. al*., 2011) [50]. Incorporation of these two ingredients with buckwheat and wheat flour might elevate the ash content of developed product. (Fig 6)

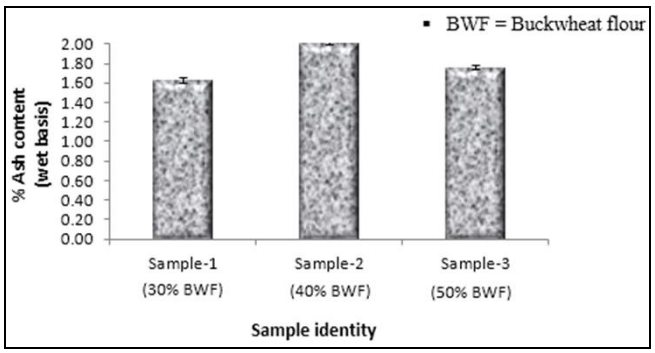



**Fig 6:** Effect of various ingredients incorporation on ash content of composite biscuits

### 3.2.3 Protein content

Fig 4.2.3 displays that the highest protein content was found in sample-1 and the lowest in sample-2. The mean protein content was found 9.66±0.03, 8.51±0.03, 7.19±0.04 respectively for three samples. Another study was performed previously by( Baljeet *et. al*., 2010) [19] they summarized that mean protein content of buckwheat biscuits decrease (7.5-5.5%) with the increasing of buckwheat incorporation (10-40%) with wheat flour, due to low protein content of buckwheat flour than refined wheat flour (Guo *et. al*., 2007) [43]. Present study also indicates the decreasing trend of protein content with increasing of buckwheat content but overall result climbs little higher than the previous one. The higher protein content might be due to the origin, species and treatment of wheat and buckwheat (Pandey *et. al*., 2015, Snape *et. al*., 1993) [44,45]or might be the addition of honeyweed and stevia which has higher protein content than added two flour (Tadhani and Subhas, 2006)[46]. (Fig. 7)

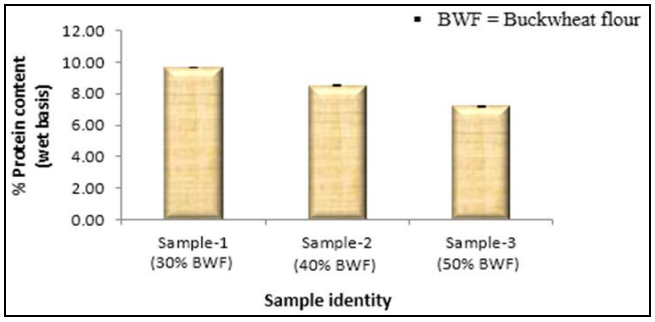



**Fig 7:** Effect of various ingredients incorporation on protein content of composite biscuit

### 3.2.4 Fat content

Present study reveals that fat percentage increases with the increasing of buckwheat incorporation (Baljeet *et. al*., 2010 and Ulfat *et. al*., 2015 [19, 20] also found the same phenomenon while preparing biscuits or cookies with the incorporation buckwheat flour with wheat flour. They reported 21-23% fat content with the increasing of buckwheat incorporation about 10-40% with wheat flour. This increasing trend was probably due to the oil retention ability of buckwheat flour during baking process (Kaur *et. al*., 2014) [47]. Present result has climbed up little higher than the previous literature. The origin, species, treatment method of raw ingredients or incorporation of two new ingredients in the mix or the process variation in developing products might be the reason behind it. (Fig 8)

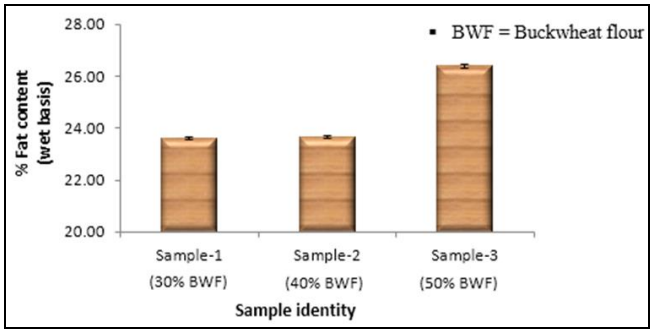



**Fig 8:** Effect of various ingredients incorporation on fat content of composite biscuit

### 3.2.5 Fiber content

Fig 4.2.5 illustrates the upward trend of fiber content with the increasing percentage of buckwheat flour incorporation. Same issue was perceived by (Ulfat *et. al*., 2015) [20] and they reported around 1.3-2.6% fiber content for 0-60% incorporation of buckwheat flour with wheat flour. This is because of high crude fiber content of buckwheat flour. Present study shows little bit greater result than previous study. Stevia possess around 15-18% fiber content (Serio *et. al*., 2010 and Mishra *et. al*., 2010) [48, 49] and honeyweed contains around 21-23 % fiber. Incorporation of these two ingredients might bethe possible reason (Fig 9).

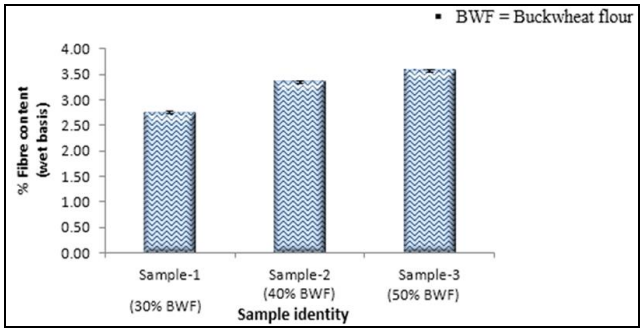



**Fig 9:** Effect of various ingredients incorporation on fiber content of composite biscuit

### 3.2.6 Carbohydrate content

Fig 4.2.6 depicts that there was no significance difference in sample-1 and sample-2 and sample-3 had maximum amount of carbohydrate. (Baljeet *et. al*., 2010) [19], reported the variation of carbohydrate content ranges between 65-67% for the incorporation of 10-40% buckwheat flour with wheat flour. Present study demonstrates lower value than previous study. Carbohydrate content was determined by difference method so variation of other components might be the reason for the deviation of present result. (Fig 10)

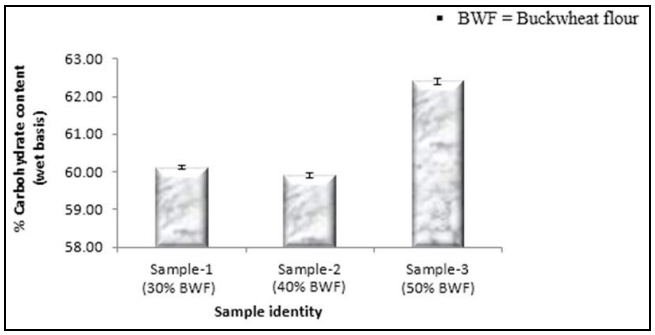



**Fig 10:** Effect of various ingredients incorporation on carbohydrate content of composite biscuits

## 4. Sensory Quality Evaluation

Table 3, reflects the effect of incorporation of buckwheat, honeyweed and stevia on the sensory characteristics of biscuits. Amount of honeyweed and stevia were kept constant so the change of sensory acceptability due to the variation of buckwheat incorporation with wheat flour.

**Table 2:** Sensory quality of composite biscuits

| Sample code | Appearance | Texture | Taste | Overall acceptability |
|---|---|---|---|---|
| S-1 | 6.65±0.11$^{a}$ | 7.60±0.11$^{a}$ | 7.85±0.11$^{a}$ | 7.65±0.11$^{a}$ |
| S-2 | 6.05±0.15$^{b}$ | 7.55±0.11$^{a}$ | 7.35±0.13$^{b}$ | 7.25±0.16$^{ab}$ |
| S-3 | 6.00±0.09$^{b}$ | 7.50±0.14$^{a}$ | 7.15±0.18$^{b}$ | 7.05+0.17$^{b}$ |

Here, S-1: 30% buckwheat flour, S-2: 40% buckwheat flour, S-3: 50% buckwheat flour, the values are mean ± S.E of three independent determinations. The value with different superscripts in a column differ significantly ($p \leq 0.05$).

With the increasing amount of buckwheat incorporation the sensory attributes of biscuits decreased. The decreasing in appearance acceptability is due to buckwheat flour has darker color than wheat flour (Yadav *et. al*., 2010, Baljeet *et. al*., 2010 and Ulfat *et. al*., 2015) [19, 20, 50]. Present study displays lower result in terms of color than previous study because honeyweed has darker color which makes the dull appearance of the biscuits. The score of texture of the biscuits was found softer with the increasing amount of buckwheat incorporation because of the addition of non-glutenous nature of buckwheat and gluten free flour reduces the textural strength of biscuits (Schober *et. al*., 2003) [51]. The aesthetical value of taste was reduced with the elevating concentration of buckwheat, probably due to the presence of phenolic compound abundantly in buckwheat which causes bitter taste (Sedej *et. al*., 2011) [52]. But present study shows higher value for taste, possibly due to the presence of stevia which is 250-300 times sweeter than sucrose (Allam *et. al*., 2001; and Debnath, 2008) [53, 54] and this sweetening agent has masked the bitter taste of honeyweed and buckwheat.

## 5. Conclusion

The study was carried out to prepare high fiber composite biscuit substituting wheat flour by buckwheat and honeyweed. The effect of buckwheat and honeyweed powder on nutritional and consumer acceptance of the prepared biscuit were also evaluated. Bbuckwheat and honeyweed samples were dried by sun drying method. Powder of both samples was prepared by grinder machine. The biscuits were prepared by using wheat flour, buckwheat flour, honeyweed powder, stevia, baking powder, egg and shortening (oil and dalda). In order to produce certain amount of each biscuit, the changing amount of wheat and buckwheat flour were used for three formulation namely, sample 1 (30% buckwheat flour), sample 2 (40% buckwheat flour), sample 3 (50% buckwheat flour). After mixing all ingredients properly, dough was prepared, cut for desired biscuit shapes and baked at 160$^{o}$C for 30 minutes. Nutritional quality of prepared biscuit was analyzed in terms of moisture, protein, fiber, fat, ash and carbohydrate contents. On the other hand, the sensory evaluation of prepared biscuit was carried out on the basis of sensory attributes including color, flavor, texture, taste, and overall acceptability. Analysis result revealed that incorporation of buckwheat, honeyweed, and stevia positively affected the nutrient content of prepared biscuits. The result illustrated that, the moisture contents and protein found to be decreased but fiber, ash increased. Sensory analysis provided that, sample 1 was obtained the highest scores in all sensory attributes.

From the above discussion it is evident that, incorporation of buckwheat, honeyweed and stevia in wheat flour had significant effect on both nutritional and sensory properties. From previous literature, it was observed that, above stated ingredients had several medicinal values such as anti-diabetic and anti-inflammatory properties, antioxidant activities, free radical scavenging activities and many more. So further studies can be conducted to analyze the bioactive compounds of these prepared biscuits and its effect on human body.

## 6. References


1. Manley Biscuit DJR. Cookies and Crackers Manufacturing, Manual 6: Packaging and Storing. 3rd Ed. (Woodhead Publishing Limited, Cambridge), 1998.
2. Akubor P. Functional properties and performance of cowpea/plantain/wheat flour blends in biscuits. Plant Food for Human Nutrition. 2003; 58:1-8.
3. Hooda S, Jood S. Organoleptic and nutritional evaluation of wheat biscuits supplemented with untreated and treated fenugreek flour. Food Chemistry. 2005; 90:427-435.
4. Ahmed F, Islam MA, Rahman MM. Antibacterial activity of Leonurus sibiricus aerial parts. Fitoterapia. 2006; 77:316-7.
5. Md. Abu Sayed, Leonurus sibiricus L. (honeyweed): A review of its phytochemistry and pharmacology. Asian Pac J Trop Biomed. 2016; 6(12):1076-1080.
6. Rahmatullah M, Rahman MA, Haque MZ, Mollik MAH, Miajee ZUM, Begum R, *et al*. A survey of medicinal plants used by folk medicinal practitioners of Station Purbo Para village of Jamalpur Sadar Upazila in Jamalpur district, Bangladesh. Am Eur J Sustain Agric. 2010; 4:122-35
7. Narukawa Y, Niimura A, Noguchi H, Tamura H, Kiuchi F. New diterpenoids with estrogen sulfotransferase inhibitory activity from Leonurus sibiricus L. J Nat Med. 2014; 68:125-31.
8. Tasdemir D, Wright AD, Sticher O, Çalis I, Linden A. Detailed 1Hand 13C-NMR investigations of some diterpenes isolated from Leonurus persicus. J Nat Prod. 1995; 58:1543.
9. Chua HP, Fasihuddin BA, Aminah A, Wong MH. Analysis of nutritional value and essential oil chemical composition of Sarawak's medicinal herb kacangma (*Leonurus sibiricus*). J Trop Agric Food Sci, 2005;

33:53-64.
10. Marshall HG, Pomeranz Y. Buckwheat description, breeding, production and utilization. In Y. Pomeranz (Ed.), Advances in cereal science and technology. St. Paul, MN: American Association of Cereal Chemistry, 1982, 157-212.
11. Li S, Zhang QH. Advances in the development of functional foods from buckwheat. Critical Reviews in Food Science and Nutrition. 2001; 41:451-464.
12. Fabjan N, Rode J, Kosir IJ, Zhang Z, Kreft I. Tatary buckwheat (*Fagopyrum tartaricum* Gaertn.) as a source of dietary rutin and quercitrin. Journal of Agricultural and Food Chemistry. 2003; 51:6442-6455.
13. Bonafaccia G, Marocchini M, Kreft I. Composition and technological properties of the, flour and bran from common and tartary buckwheat. Food Chemistry. 2003; 80:9-15.
14. Ikeda S, Yamashita Y. Buckwheat as a dietary source of zinc, copper and manganese. Fagopyrum Oomah BD, Mazza G., 1996. Flavonoids and antioxidative activities in buckwheat. Journal of Agricultural and Food Chemistry. 1994; 44:1746-1750:11-15.
15. Holasova M, Fiedlerova V, Smrcinova H, Orsak M, Lachman J. Buckwheat-the source of antioxidant activity in functional foods. Food Research International. 2002; 35:207-211.
16. Zdunczyk Z, Flis M, Zielinski H, Wroblewska M, Antoszkiewicz Z, Juskiewicz J. *In vitro* antioxidant activities of barley, husked oat, naked oat, triticale, and buckwheatwastes and their influence on the growth and biomarkers antioxidant status in rats. J Agric Food Chemistry. 2006; 54:4168-4175
17. Oomah BD, Mazza G. Flavonoids and antioxidative activities in buckwheat. Journal of Agricultural and Food Chemistry. 1996; 44:1746-1750.
18. Wanatabe M. Catechins as antioxidant from buckwheat (*Fagopyrum esculentum* Moench) groats. Journal of Agricultural and Food Chemistry. 1998; 46:839-845.
19. Baljeet SY, Ritika BY, Roshan LY. Studies on functional properties and incorporation of buckwheat flour for biscuit making. Int Food Res. 2010; 17:1067-1076.
20. Ulfat Jan. Characterization of cookies made from wheat flour blended with buckwheat flour and effect on antioxidant properties. J Food Sci. Technol. 2015; DOI 10.1007/s13197-015-1773-8
21. Abdullateef RA, Osman M. Studies on effects of pruning on vegetative traits in *Stevia rebaudiana* Bertoni (Compositae). Int. J Biol. 2012; 4:146-153.
22. Ahmed B, Hossain M, Islam R, Kumar Saha A, Mandal A. A review on natural sweetener plant – stevia having medicinal and commercial importance. ISSN, 2011; 0002.
23. Savita SM, Sheela K, Sunanda S, Shankar AG, Ramakrishna P, Sakey S. Health implications of *Stevia rebaudiana*. J Hum. Eco. 2004; 15:191-194.
24. Wood HB, Allerton Jr, Diehl HW, Fletcher HG. The structure of the glucose moieties. J Org. Chem, 1955; 20:875-883.
25. Goyal SK, Samsher RK, Goyal. Stevia (*Stevia rebaudiana*) a bio-sweetener- a review. Int J Food SciNutr. 2010; 61(1):1-10.
26. Boonkaewwan C, Ao M, Toskulkao C, Rao MC. Specific immunomodulatory and secretory activities of stevioside and steviol in intestinal cells. J Agric Food Chem. 2008; 56:3777-84.
27. Yasukawa K, *et al*. Inhibitory effect of stevioside on tumor promotion by 12-0-tetradecanoylphorbol-13-acetate in two stage carcinogens in mouse skin. Pharm Bull. 2002; 25(11):1488-90.
28. Lailerd N, Saengsirisuwan V, Sloniger JA, Toskulkao C, Henriksen EJ. Effects of stevioside on glucose transport activity in insulin-sensitive and insulin-resistant rat skeletal muscle. Metabolism. 2004; 53(1):101-107.
29. Dyrskog SE, Jeppensen PB, Colombo M, Abudula R, Hermansen K. Preventive effects of soy based diet supplemented with stevioside on development of type 2 diabetes. Metabolism. 2005; 54:1181-1188.
30. Pol J, Hohnová B, Hyötyläinen T. Characterization of *Stevia rebaudiana* by comprehensive two-dimensional liquid chromatography time-of-flight mass spectrometry. J Chromatogr. A. 2007; 1150:85-92.
31. Brandle JE, Rosa N. Heritability of yield, leaf-steam ratio and stevioside content estimated from a ladrace cultivar of *Stevia rebaudiana*. Can. J Plant Sci. 1992; 72:1263-1266.
32. Costa AGV, Garcia-Diaz DF, Jimenez P, Silva PI. Bioactive compounds and health benefits of exotic tropical red–black berries. Journal of Functional Foods. 2013; 5:539-549.
33. Goesaert K, Brijs WS, Veraverbeke CM, Courtin K, Gebruers JA. Delcour, Wheat flour constituents: how they impact bread quality, and how to impact their functionality, Trends in Food Science & Technology. 2005; 16:1-3, 12-30,ISSN0924-2244, https://doi.org/10.1016/j.tifs.2004.02.011.
34. Garcia-Serna E, Martinez-Saez N, Mesias M, Morales FJ, Castillo M. Use of Coffee Silverskin and Stevia to Improve the Formulation of Biscuits, Polish Journal of Food and Nutrition Sciences. 2014; 64(4):243-251.
35. Md. Ariful Alam, Md. Jahangir Alam, Md. Abdul Hakim AK, Obidul Huq SM. Golam Moktadir. Development of Fiber Enriched Herbal Biscuits: A Preliminary Study on Sensory Evaluation and chemical Composition. International Journal of Nutrition and Food Sciences. 2014; 3(4):246-250.
36. Amit Arjun Kulthe. Development of high protein and low calorie cookies. J Food Sci Technol, 2011. DOI 10.1007/s13197-011-0465-2.
37. Azza A Omran. Quality characteristics of biscuit prepared from wheat and flaxseed flour. Advances in food science. 2016; 38(4):129-138.
38. Trushwell AS. Cereal grains and coronary heart disease. Eur J Clin Nutr. 2002; 56:1-14.
39. Debra Zoran L, Nancy Turner D, Stella Taddeo S, Robert Chapkin S, Joanne Lupton R. Wheat Bran Diet Reduces Tumor Incidence in a Rat Model of Colon Cancer Independent of Effects on Distal Luminal Butyrate Concentrations, The Journal of Nutrition. 1997; 127:217-2225. https://doi.org/10.1093/jn/127.11.2217.
40. Halliwell B. How to characterize a biological antioxidant. Free Radic Res. 1990; 9(1):1-32.
41. Mpofu A, Sapirstein HD, Beta T. Genotype and environmental variation in phenolic content, phenolic acid composition, and antioxidant activity of hard

spring wheat. J Agric Food Chem. 2006; 54:1265-1270.
42. Atteh J, Onagbesan O, Tona K, Buyse J, Decuypere E, Geuns J. Potential use of *Stevia rebaudiana* in animal feeds. Arch. Zootec. 2011; 60:133-136.
43. Guo XN, Zhu KX, Zhang H, Yao HY. Purification ancharacterization of the antitumor protein from Chinese tartary buckwheat (*Fagopyrum tataricum* Gaertn.) water-soluble extracts. Journal of Agricultural and Food Chemistry. 2007; 55:6958–6961.
44. Pandey Shruti. Effect of Hydrothermal Treatment on the Nutritional and Functional Properties of Husked and Dehusked Buckwheat. J Food Process Techno. 2015; 6:7. DOI: 10.4172/2157-7110.1000461
45. Snape J, Hyne V, Aitken K. Targeting genes in wheat using marker mediated approaches. In: Proceedings of the 8th international wheat genetics symposium, Beijing, 1993, 749-759.
46. Tadhani M, Subhash R. Preliminary studies on *Stevia rebaudiana* leaves: Proximal composition, mineral analysis and phytochemical screening. J Med. Sci. 2006; 6:321-326.
47. Kaur M, Singh KS, Arora AP, Sharma A. gluten free cookies prepared from buckwheat flour by incorporation of various gums: physicochemical and sensory properties. LWT Food Sci Technol. 2014; doi:10.1016/j.lwt.2014.02.039.
48. Serio L. La *Stevia rebaudiana*, une alternative au sucre. Phytothérapie. 2010; 8:26-32.
49. Mishra P, Singh R, Kumar U, Prakash V. *Stevia rebaudiana*-A magical sweetener. Global. J Biotech. Biochem. 2010; 5:62-74.
50. Yadav BS, Ritika BY, Roshan LY. Studies on functional properties and incorporation of buckwheat flour for biscuit making. Int Food Res J. 2010; 17:1067-1076.
51. Schober TJ, Brien CM, McCarthy D, Barnedde A, Arendt EK. Influence of gluten free flour mixes and fat powders in the quality of gluten free biscuits. European Food Research Technology. 2003; 5:369-376.
52. Bojana Filipčev, Olivera Šimurina, Marijana Sakač, Ivana Sedej, Pavle Jovanov, Mladenka Pestorić, Marija Bodroža-Solarov. Feasibility of use of buckwheat flour as an ingredient in ginger nut biscuit formulation, Food Chemistry, 2011; 125(1):164-170. ISSN 0308-8146, https://doi.org/10.1016/j.foodchem.2010.08.055.
53. Allam AI, Nassar AM, Besheite SY. Nitrogen fertilizer requirement of Stevia rabaudiana Bertoni under Egyptian condition. Egyptian J Agric Res. 2001; 79:1005-1018.
54. Debnath M. Clonal propagation and antimicrobial activity of an endemic medicinal plant *Stevia rebaudiana*. J Med. Plant Res. 2008; 2:045-051.