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### Khule GD

Department of Food Process Engineering, Vaugh Institute of Agricultural Engineering and Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

### Khupase SP

Department of Food Process Engineering, Vaugh Institute of Agricultural Engineering and Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

### Giram KK

Department of Food Process Engineering, Vaugh Institute of Agricultural Engineering and Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

### Correspondence

#### Khule GD

Department of Food Process Engineering, Vaugh Institute of Agricultural Engineering and Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

## Development and quality evaluation of orange pomace fortified biscuits

Khule GD, Khupase SP and Giram KK

### Abstract

To Study the preparation of orange pomace powder fortified biscuit and its shelf life were studied. Orange pomace was with wheat flour or (Maida) in different proportions having following ratios (i.e. control sample T0-100:00, Sample T1- 95:05, Sample T2-90:10 and Sample T3-85:15). Physico-chemical and sensory parameters of orange pomace fortified biscuits were analyzed after baking. prepare Orange pomace fortified biscuits were analyzed for physical analysis diameter, thickness, spired ratio, (6.85,6.004, 0.71, 8.78) respectively. In Chemical analysis Moisture content of control sample and others of any treatment did not show any increase or decrease from 0 to 10 day. Protein content in experimental samples was found 7.09 in sample T0 and 8.49 in Sample T3 g/100gm. Fat content in experimental sample was found 16.8 in sample T0 and 17.12 in sample T3 g/100gm. fat content of control and treatment sample did not show any increase or decrease from 0 to 10 days but after 20, 30 and 40 days there was a slight change in fat content of all samples. Ash content of experimental sample was found minimum 1.66 percent in sample 100:00 and maximum 3.50 percent in sample 85:15. Fiber content in experimental sample was found in 1.60 in control sample and 3.20 in T3. Fiber content are increased when orange pomace powder proportion are increased. In sensory analysis sample T2 (90:10) are more acceptable as compare to other sample.

**Keywords:** Orange pomace, biscuits, wheat flour, moisture, ash, fat, protein and fiber

### Introduction

Commonly the term "Biscuit" is used for describing low moisture, hard-eating, sweetened, thin product with a long shelf-life that is eaten as snack. According to Fayemi (1981) biscuit is defined as a small thin crispy cake made from unleavened dough.

Biscuits are an important baked product in human diet and are usually eaten with tea or a whole. It is also used as weaning food for infants and school children who are often often underweight ACC/SCN, (1987) use them as snack. In recent years biscuits is widely consumed and becoming popular as the time is passing. It is the most common "Instant Food Item" and affordable for consumption for almost all the economic class population throughout the globe.

In India, Biscuits contributes almost 33% of the total share of bakery industry. According to recent figures, the total production of biscuits in india was nearly 13, 25,000 tonnes in 2012-13. It is estimated that the production and market for biscuits in India is ever increasing.

Now a day the by-products of Food processing industry are a major problem. e.g. From the total orange production, 70% of orange is used to manufacture derivative products but approximately 50 to 60 % of the processed fruit is transformed into citrus peel waste (peel, seeds and membrane residues). So in this waste there are lot of nutritional losses occurs. Such as orange peels and pomace that are considered important factors of therapeutic diets and nutrient effect supplying. The dietary fibres are the indigestible, fibrous parts of citrus fruits are an essential part of our diet. Because of their water retaining properties, fibres help food pass through the gut faster and therefore have a laxative effect. Fibres add bulk to the diet and fill up, making less likely to snack on fatty foods. Therefore, we need to eat fibres every day as part of a balanced diet (Youssef, 2007) <sup>[20]</sup>. essential nutrient elements such as fiber, vitamin and mineral to human body.

Through these efforts we converting these refused materials into valuable products. Our objective is develop orange pomace fortified biscuit by using the orange pomace and increasing the nutritional status of biscuit.

## 2. Materials and Methods

### 2.1 Raw material

Orange, Wheat Flour, Vegetable Oil, Baking powder, Milk powder, Sugar, Salt, Petroleum Ether, Concentrated H<sub>2</sub>SO<sub>4</sub>, Sodium Hydroxide etc.

## 2.2 Methodology to Development of Orange Pomace fortified Biscuits

### 2.2.1 Formulation for Orange Pomace fortified Biscuits

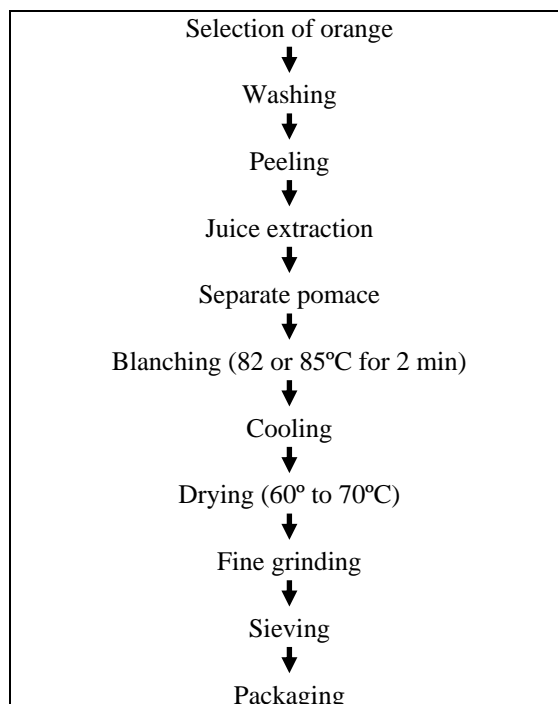
We prepare the various samples and through obtained result we develop 4 different samples according to given formulation.

**Table No. 1:** Standardized ratio in biscuit by using wheat flour and orange powder in different samples

Sr. No.	Sample	Wheat flour (%)	Orange Pomace powder (%)
1.	T <sub>0</sub>	100	0
2.	T <sub>1</sub>	95	5
3.	T <sub>2</sub>	90	10
4.	T <sub>3</sub>	85	15

### 2.2.2 Methods for the development of orange pomace powder

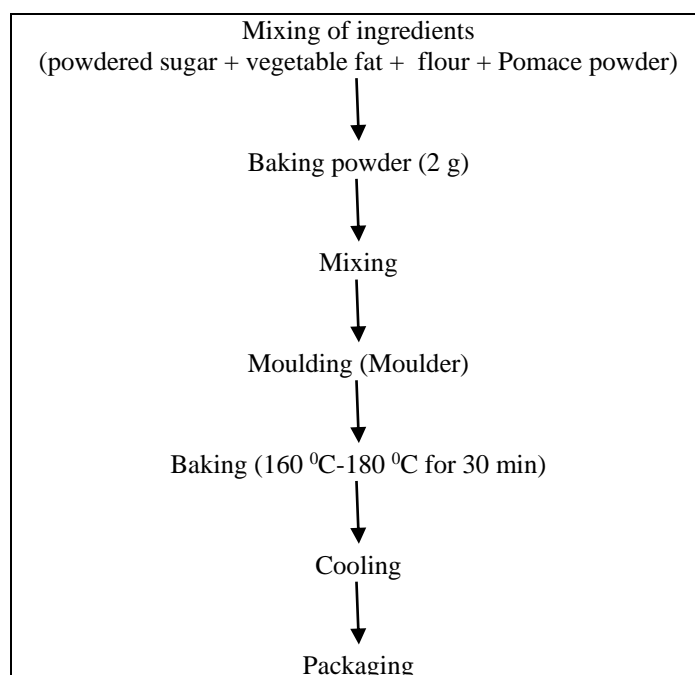
First we wash orange with clean water to remove dirt and other material from orange then we peel orange and juice will be extracted by using juice extractor and then we get separated the orange pomace from orange. We exposed orange pomace to hot air at 70-100 °C temp for 3hr. through that moisture loss up to 98.05%. Then we dry pomace is ground to fine powder to pass through 40 and 60 mesh sieves and packed in airtight LDPE polyethylene.



**Fig 1:** Process flow sheet for development of orange pomace powder.

### 2.2.3 Development of orange pomace fortified biscuit

#### Mixing of ingredients



**Fig 2:** Process flow sheet for development of orange pomace biscuit

## 2.3 Analysis of orange pomace Powder Fortified Biscuits

### 2.3.1 Physical analysis:

Orange pomace powder fortified Biscuits were analyzed for weight, Diameter, thickness, spread ratio, by following the respective procedures (AACC, 2000) <sup>[1]</sup>.

**Diameter (D):** Six Orange pomace powder fortified biscuits were placed horizontally and rotated at 90° angle for reading. measured by vernier caliper.

**Thickness (T):** Orange pomace powder fortified biscuits thickness was measured with a vernier caliper in triplicate.

readings were recorded. Six cookies were measured one-by-one.

**Spread ratio (SF):** It was calculated by dividing diameter by thickness

$$SF = \frac{D}{T}$$

### 2.3.2 Chemical Analysis

**Moisture:** Estimation of moisture content is done by hot air oven method at 105 °C for 4 hrs (AOAC, 1995) <sup>[2]</sup>.

**Ash:** estimation of ash content By using muffle furnace method up to constant weigh. Ignite in a muffle furnace at 550 °C for 4 hrs

**Fat:** estimation of fat content are done by Soxhlet apparatus for 6-8 h using petroleum ether. The solvent is evaporated and the residue is weighed (Ranganna, 1986).<sup>[6]</sup>

**Protein:** The estimation of protein is done by Kjeldahl method where in the protein content is obtained by multiplying the nitrogen value with 6.25 (Ranganna, 1986).<sup>[6]</sup>

**Fibre:** Fibre is loss on ignition of dried residue remaining after sequential digestion of sample with 1.25% H<sub>2</sub>SO<sub>4</sub> (0.25 ± 0.005) and 1.25% NaOH (0.313 ± 0.005N) solution specific conditions.

### 2.3.3 Sensory Analysis

**Sensory evaluation:** The Orange pomace powder fortified biscuit samples were

Evaluate for acceptability based on its flavour, colore, texture, appearance, and overall acceptability using nine-point hedonic scale.

**9-Point Hedonic Scale** are (9=Like Extremely, 8=Like Very Much, 7=Like Moderately, 6=Like Slightly, 5=Neither Like nor Dislike, 4=Dislike Slightly, 3=Dislike Moderately, 2=Dislike Very Much, 1=Dislike Extremely)

### 2.3.4 Shelf life analysis

The Orange pomace powder fortified biscuit samples were packed in LDPE packaging material under ambient temperature for 40 days has evaluated.

## 3. Results and Discussion

The investigation were conducted for “Development and quality evaluation of orange pomace powder fortified biscuits”. The present study was under taken to evaluate the quality as well as acceptability of utilization of orange pomace for the preparation of biscuit. The physical, chemical, sensory and storage evaluation of biscuit had been analyzed.

Studies of physico-chemical analysis of (moisture, fat, protein, ash, fibre content) and sensory properties, which were influenced by packaging material, storage of environmental condition and chemical constituents. The shelf life studies were conducted at the interval of 10 to 40 days. The results of the study are as presented and discussed in these section.

### 3.1 Physical Analysis of Orange pomace Powder Fortified Biscuit

Physical properties (diameter, thickness, spread ratio) of orange pomace powder fortified biscuits were studied. During present experiment it was observed that the diameter, thickness and spread ratio have been affected by the different time and temperature combinations.

**Diameter:** The diameter of biscuit was change after baking it was not constant for all samples. The diameter of baked biscuit for T<sub>0</sub> was change lightly during baking at temperature 160 °C 30 min. But the remaining sample was changes in their diameter on 160 °C 30 min any effect were observed. Sample T<sub>1</sub>, T<sub>2</sub> T<sub>3</sub> there was an effect observed during baking time in different temperature. The reason of this change in diameter of biscuits sample was their proportion of orange pomace powder and wheat flour (maida) ratio significantly change were seen during the time of diameter measurement.

**Thickness:** Thickness was found maximum (0.9) in those samples which were baked for 30 minute at the temperature 160 °C and which also prepare by using orange pomace. Effect of treatment and baking time was also observed on the thickness of the biscuits on all sample. this physical analysis observed shown in chart -1.

**Spread ratio:** Spread ratio: During present study it was observed that the thickness of the biscuits remain constant when it was baked at 160 °C for 30 minute. Small effect of different treatment i.e. (T<sub>1</sub> T<sub>2</sub> T<sub>3</sub>) for 30 min at 160 °C was observed on the thickness of biscuit sample T<sub>3</sub> was lightly changed. change are observed on the spread ratio of the biscuits when it was baked for more time (30 minute). spread ratio of the product was observed and significantly change in their baking temp and time of biscuit. A biscuit containing more orange pomace powder shows change in spread ratio.

### 3.2 Chemical Analysis of Orange pomace Powder Fortified Biscuit

**Moisture** content in the sample was found in the range of 1.2 to 1.9 %.It was seen that there is marked effect of orange pomace powder proportion on moisture content. Moisture content was found maximum (1.9%) in the sample containing 15 % orange peel (T<sub>3</sub>), it was found minimum (1.2%) in the control sample (T<sub>0</sub>).

Protein content of orange pomace powder fortified biscuits found in the range of 7.09 to 8.49 %. It was observed that there is marked effect of orange pomace powder and maida flour proportion on protein content. The protein content was found maximum (8.49%) in the sample containing 15 % orange pomace powder (T<sub>3</sub>). It was found minimum (7.09%) in the control sample (T<sub>0</sub>). It may be due to the proportion of flour and pomace powder.

Fat content of orange pomace powder fortified biscuits found in the range of 16.08 to 17.12%, it is observed that there is effect of vegetable fat on the proportion of fat content. The fat content was found minimum (16.08%) in the control sample (T<sub>0</sub>). It was content was found maximum (17.12%), in the sample containing 15 % orange peel (T<sub>3</sub>).

Ash content of orange pomace powder fortified biscuits was found in the range of 1.66 to 3.50%, it was observed that there is marked effect of orange pomace powder and maida flour proportion on the ash content. The ash content was found maximum (3.50%) in the sample containing 15 % orange pomace powder (T<sub>3</sub>), it was found minimum (1.66%), in the control sample (T<sub>0</sub>).

Fibre content of orange pomace powder fortified biscuits was found in the range of 1.60 to 3.20% it was observed that there is marked effect of orange pomace proportion on fibre content. Pomace proportion are increased then fibre content were increased as compare to other sample. Fiber content was found maximum (3.20) in the sample containing 15% orange pomace (T<sub>3</sub>), it was found in minimum (1.60) in the control sample (T<sub>0</sub>).

### 3.3 Sensory Analysis of Orange Pomace Powder Fortified Biscuits

Sensory analysis of orange pomace biscuit during storage was done on the basis of color, flavour, texture, taste and overall acceptability. Sensory analysis of orange pomace biscuit of sample T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was carried out on the basis of color, flavour, texture, taste and overall acceptability with the help of sensory evaluator on 9 point hedonic scale. Sample T<sub>1</sub> and T<sub>2</sub> were more acceptable as compare to other sample

**Table 2:** Mean sensory analysis of orange pomace biscuits

Sample	Color	Taste	Flavour	Texture	Appearance	Overall Acceptability
T <sub>0</sub>	7	7	8	6	7	7
T <sub>1</sub>	7	8	8	7	7	7.5
T <sub>2</sub>	8	8	8	7	8	8
T <sub>3</sub>	7	8	7	8	8	7

### 3.4 Effects of Storage Day on Chemical Composition of Orange pomace Fortified Biscuits

#### 3.4.1 Effects of storage day on percent moisture content on wet basis of orange pomace biscuits

The percent moisture score for T<sub>0</sub> was 1.26 percent on 0 day, 1.31 percent after 10 days, 1.40 percent after 20 days, 1.44 percent after 30 days and 1.55 percent after 40 days. Similarly for sample T<sub>1</sub>, it was 1.39 percent on 0 day, 1.47 percent after 10 days, 1.56 percent after 20 days, 1.69 percent after 30 days and 1.83 percent after 40 days. Moisture content of the sample T<sub>2</sub> and T<sub>1</sub> was having significant effect because of the pomace. T<sub>2</sub> sample was 1.41 percent on 0 days, 1.52 percent on 10 days, 1.62 percent moisture content on 20 days, 1.75 on 30 days, 1.85 percent on 40 days during storage day of biscuits. As compare to T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub>, T<sub>3</sub> sample was sharply increased with its moisture content during storage i.e., 1.44 percent on 0 days, 1.56 percent on 10 days, 1.64 percent on 20 days, 1.81 percent on 30 days, 1.96 percent on 40 days. Table 4.1 and Figure 4.1 shows significant change during storage days. T<sub>0</sub> was 1.55, T<sub>1</sub> was 1.83, T<sub>2</sub> was 1.85 and T<sub>3</sub> was 1.96 for period of shelf life. T<sub>3</sub> treatment sample sharply increase its moisture content as compare to other because of proportion of pomace in T<sub>3</sub> sample were 85:15. Therefore, moisture content in biscuit reached highest level.(0 day, 10 days, 20 days, 30 days and 40 days). Increase in moisture content in biscuit is due to improper storage condition and also due to improper packaging and sharply increase in moisture content in sample T<sub>3</sub> is due to present of certain carbohydrate which are hygroscopic in nature. Hershy *et al.* (1995) [8] found similar result on orange pomace contain certain carbohydrate material which are hygroscopic in nature and orange pomace on storage absorb moisture from atmosphere. So in T<sub>3</sub> sample on storage absorb more moisture from atmosphere as compared to other sample.

#### 3.4.2 Effects of storage day on percent Ash content of orange pomace biscuits

The ash content in the food stuff represents inorganic matters remaining after the organic matters have been burnt. The percent ash scores for T<sub>0</sub> was 1.66 percent on 0 day, 1.71 percent after 10 days, 1.74 percent after 20 days, 1.77 percent after 30 days and 1.81 percent after 40 days. Similarly for sample T<sub>1</sub> scored 2.16 percent on 0 day, 2.20 percent after 10 days, 2.23 percent after 20 days, 2.26 percent after 30 days and 2.33 percent after 40 days. Sample T<sub>2</sub> scored 2.70 percent on 0 day, 2.73 percent after 10 days, 2.76 percent after 20 days, 2.83 percent after 30 days and 2.90 percent after 40 days. Sample T<sub>3</sub> scored 3.50 percent on 0 day, 3.56 percent after 10 days, 3.60 percent after 20 days, 3.65 percent after 30 days and 3.71 percent after 40 days. Table 4.2 and Figure 4.2 show the effect of different treatment and storage days on percent ash content. Ash amount were increasing with increasing pomace amount because pomace contain inorganic material so ash contain also increasing according to it. Gell and Weasley (2001) also find similar result all food material on storage ash content of food material increase due to certain environmental factor and also due to degradation of food material and so ash content of orange pomace biscuits increase on storage.

#### 3.4.3 Effects of storage day on percent Fat content of orange pomace biscuits

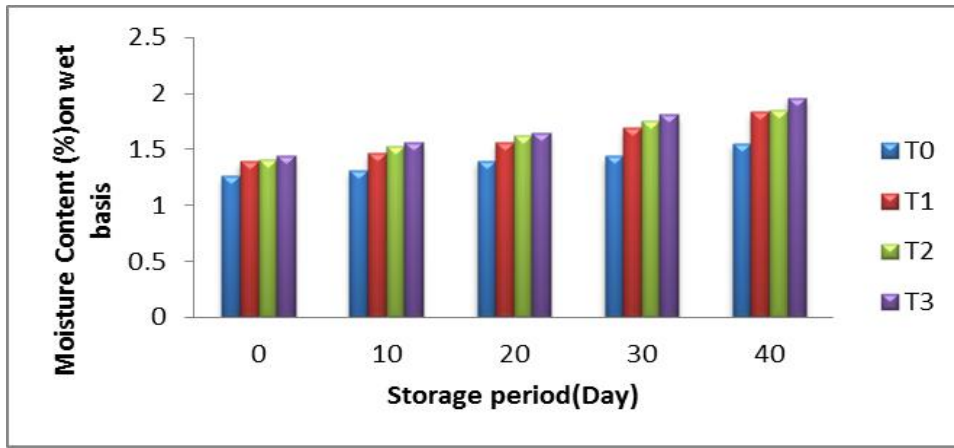
The percent fat score for T<sub>0</sub> was 16.08 percent on 0 day, 16.46 percent after 10 days, 16.21 percent after 20 days, 16 percent after 30 days and 15.80 percent after 40 days. T<sub>1</sub> scored 17.02 percent on 0 day, 16.82percent after 10 days, 16.74 percent after 20 days, 16.62 percent after 30 days and 16.48percent after 40 days. The fat content of experimental sample (T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>) was found higher than control. Table 4.3 and Figure 4.3 show the effect of different treatment and storage days on percent fat content of T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>. The data clearly indicates that there was slight decrease in fat content of sample T<sub>1</sub> and T<sub>2</sub> during storage. The results in the present study showed that there was a significant decrease in the fat content of orange pomace incorporated biscuit during storage. Denish *et al.* (2008) found similar result experimentally due to incorporation of fiber substances in food material the fat content of food material decrease on storage due to hydrolysis and other reaction.

#### 3.4.4 Effects of storage day on percent Protein content of orange pomace biscuits

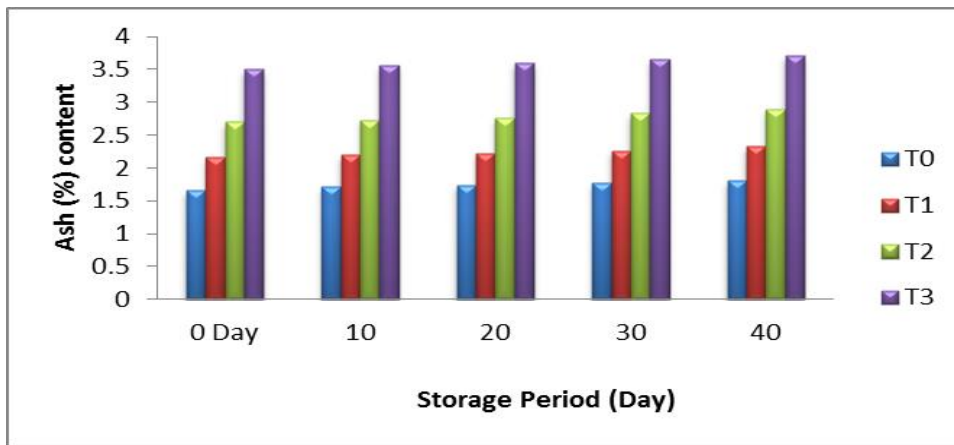
The percent protein scores for T<sub>0</sub> was 7.09 percent on 0 day, 7.04 percent after 10 days, 7 percent after 20 days, 6.91 percent after 30 days and 6.78 percent after 40 days. T<sub>1</sub> scored 7.88 percent on 0 day, 7.61 percent after 10 days, 7.53 percent after 20 days, 7.44 percent after 30 days and 7.35 percent after 40 days. T<sub>2</sub> was 8.05 percent on 0 days, 8.01 percent after 10 days, 7.96 percent on 20 days, 7.83 on 30 days, 7.74 on 40 days of percent protein content. T<sub>3</sub> was 8.49 percent on 0 days, 8.42 after 10 days, 8.38 percent on 20 days of protein content, 8.36 percent on 30 days of protein content, 8.27 on percent protein content on 40 days. Table 4.4 and Figure 4.4 shows the effect of different treatments and storage periods on percent protein content of sample (T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>) at 10 days intervals during storage. The data clearly indicated that there was slight decrease in protein content of sample T<sub>0</sub>, T<sub>1</sub> and T<sub>2</sub>. The protein content of sample T<sub>2</sub> was higher than sample T<sub>1</sub>. Therefore it can be concluded that significant effect of treatment on protein content of T<sub>1</sub> and T<sub>2</sub> sample was observed at interval of 10 days during the storage day. Maheswari and Sahani (2005) found similar result the protein content content of food materials decrease on storage due to certain denaturation reaction occurring in food materials. Protein content of T<sub>3</sub> sample is more due to presence of certain protein in orange pomace.

#### 3.4.5 Effects of storage day on percent fiber content of orange pomace biscuits

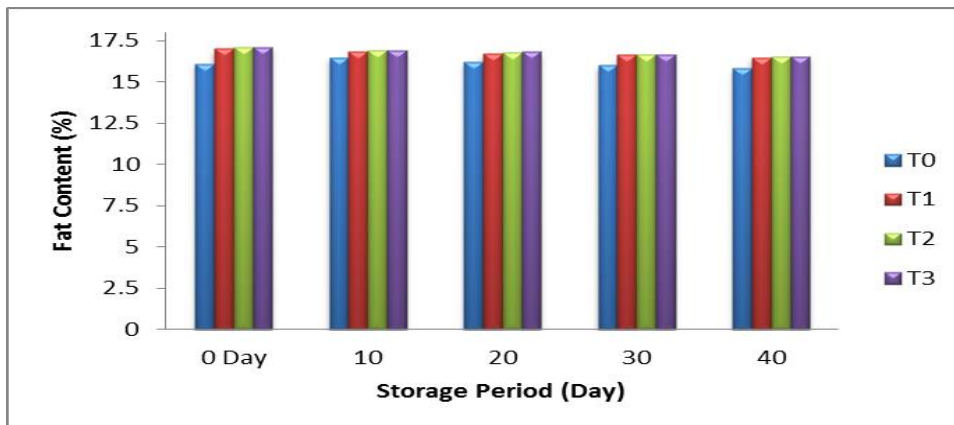
The fiber content of sample T<sub>3</sub> was higher than sample T<sub>1</sub> & T<sub>2</sub>. Therefore it can be concluded that significant effect of treatment on fiber content of T<sub>1</sub> and T<sub>2</sub>. Sample was observed at interval of 10,20, 30 and 40 days during the storage. there is no significant loss in the crude fiber content on control sample T<sub>0</sub> and Experimental sample T<sub>1</sub>, T<sub>2</sub>, and T<sub>3</sub>. fiber content of T<sub>3</sub> sample is more due to presence of certain protein in orange pomace.



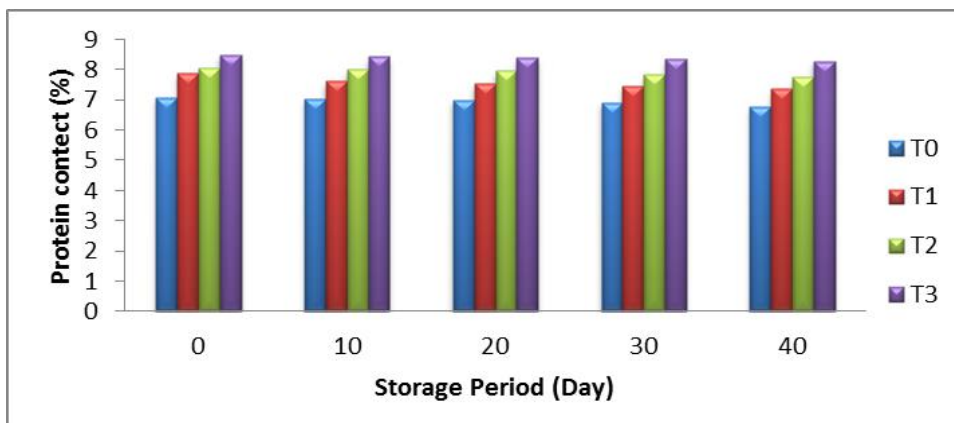
**Chart 1:** Effect of storage day on Percent moisture content on wet basis of orange pomace biscuits



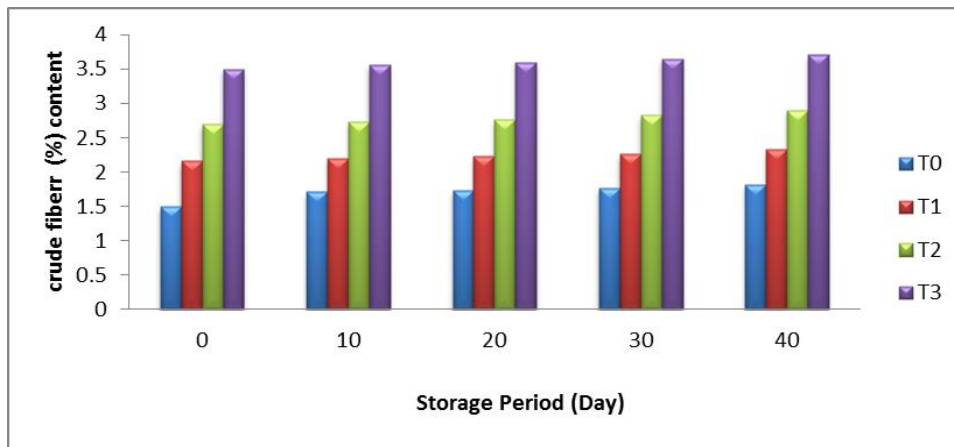
**Chart 2:** Effects of storage day on percent Ash content of orange pomace biscuits



**Chart 3:** Effects of storage day on percent Fat content on orange pomace biscuits



**Chart 4:** Effects of storage day on percent Protein content of orange pomace fortified Biscuits.



**Chart 5:** Effects of storage day on percent crude fiber content of orange pomace biscuits

### Summary and Conclusion

This chapter deals with the description of Summary and Conclusion used to accomplished the experimental work done to attained the desired objectives of the study entitled, "Development and quality evaluation of orange pomace fortified biscuits".

Studies were conducted on incorporation of orange pomace powder in biscuit. Orange pomace powder was incorporated with wheat flour in different proportion (i.e. 0%, 5%, 10%, and 15%) respectively.

Moisture content of control sample and others of any treatment did not show any increase or decrease from zero to 10 days but after 20, 30 and 40 days there was slightly increase in moisture content of control T0 treatment and experimental sample (100:00, 95:05, 90:10, 85:15).

Protein content in experimental samples was found 7.09 in sample T0 and minimum and 8.49 in Sample T3. It was also observed that after 10 days of storage protein content of orange pomace biscuits was not reduced. Fat content in experimental sample was found 16.8 that fat content of control and treatment sample did not show any increase or decrease from zero to 10 days but after 20, 30 and 40 days there was a slight decrease in fat content of control T0 and experimental sample (100:00, 95:05, 90:10, 85:15).

Ash content of experimental sample was found minimum 1.66 percent in sample 100:00 and maximum 3.50 percent in sample 85:15. It was also observed that after 10 days of storage ash content of orange pomace biscuit was slightly reduced.

Fiber content in experimental sample was found in 1.60 in control sample and 3.20 in T3. Fiber content are increased when orange pomace powder proportion are increased. In sensory analysis sample T2 (90:10) are more acceptable as compare to other sample.

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