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Research Article

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Nutritional composition of weaning food using malted cereal and pulses flour for infants

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ABSTRACT

Appropriate nutrition practice plays a vital role in determining optimal health and development of infants. The main aim of the study was to develop value added weaning food using germinated cereals and pulses flour and to assess its organoleptic quality as well as nutritional composition of prepared product. The raw materials were procured from the local market of Pratapgarh. The flour (wheat, Bajra and whole moong flour) were mixed in different proportion to prepared Sweet Porridge and named as T_1 , T_2 and T_3. Organoleptic analysis was done to assess the sensory attributes by using nine point hedonic scale. The prepared product were analysed for its nutritional composition by using the standard procedure as described by AOAC. The result shows that T_3 scored best in over all acceptability among all the treatments. The nutritional composition of product indicates that carbohydrate, energy and protein were increased with germination. Though protein value decreased in T_1 and T_3 in the developed products however it increased in T_2 showing overall best results. Hence, it was concluded that germinated grain flour can be suitably incorporated in weaning food product. Germinated flour provides concentrated form of nutrients (carbohydrates, energy and protein) in comparison to normal flour.

Keywords: *Infants, Weaning Food, AOAC and Germinated Flour.*

INTRODUCTION

During the first few months of life, breast milk or iron fortified milk alone provides optimal nutrition for the rapidly growing young infant. As physical and developmental capabilities mature, weaning is starts.

Weaning is the developmental process in which semi solid foods are introduced and the composition and consistency of diet are progressively advanced. Ideally by 12 months of age the infant is eating a variety of foods from mixed diet but breast milk, or formula is the best source of energy and nutrients. Pattern of introduction of supplementary foods should be based on the individual infant's nutritional needs, physiological maturation and the development of feeding skills.

Weaning foods are complementary in nature- that is, they complement mother's milk. The basic purpose to introducing these foods is a) to provide the taste and variety to the baby's diet, b) to provide the "missing" nutrients, c) to teach the baby swallowing, chewing and eating skills, and d) to habituate the baby to the exact taste and flavor of home meals. Begins with liquids, then go on to semisolids and finally to normal home foods. By the age of ten months, the baby should be eating an almost full diet[13].

Amylase, an enzyme having physiological, commercial and historical significance, also called diastase. It is found in both plants and animals. Amylase was purified (1835) from malt by Anselme Payen and Jean Persoz. Amylase rich weaning food as the name indicate are those feeding items in which amylase content is increased or incorporated through various methods like sprouting, germinating and many more. It is basically done with whole cereals and pulses.

In plants, starch is broken down during the germination of seeds (rich in starch) by associated plant enzymes into sugars. These constitute the chief energy source in the early development of the plants. B-amylase occurs abundantly in seeds and cereals such as malt. It also is found in yeasts, molds, and bacteria.

Amylase is calcium depend enzyme which hydrolyzes complex carbohydrate at to form maltose and glucose. Amylase is filtered by renal tubules and resorted (inactivated) by tubular epithelium. An active enzyme does not appear in urine. Small amounts of amylase are taken up by Kupffer cells in the liver.

The major cereals and millets consumed in India are rice, wheat, jowar, bajra and ragi. These grains are the main source of energy in Indian diets contributing as they do 70-80% of daily intake of majority of Indians. Since cereals/millets are the cheapest, widely available source of energy, their contribution to energy intake is the highest among the poor income families and it decreases with increasing income. In view of the large intake, cereals are an important source of several other nutrients in the Indian diets: protein, calcium, and iron and B- complex vitamin. Cereals contain 6-12% protein which is generally deficient in lysine and provides more than 50% of the daily protein intake. Cereals are also source of some nutrients like calcium and iron.

Cereals when eaten with pulses as is a common practice in India, the protein quality improves due to mutual supplementation between cereal and pulse protein, the former being deficient while the latter being rich in lysine. Pulses with their higher content of total fat (visible+invisible) contribute along with cereals to meet the EFA needs of an adult.

By the time of infant between four and six months year old, breast milk or infant formula can no longer meet nutritional needs to support growth. Supplementary foods are introduced initially to provide energy, protein, iron, vitamin C and eventually other nutrients. By the end of the first year of life, solid foods make one-third or one-half of the infant's dietary intakes.

An infant's feeding skills define his or her developmental readiness to progress from nursing to a variety of foods, textures, and feeding modes. Feeding depend on developmental of oral, hand-to-mouth fine motor, body positioning, and communication skills. As can be seen by 5 month of age the tongue and move them to the back of the mouth for swallowing. Between 5 and 7 months the infant will open her mouth the when presented with a spoonful of food and take it from the spoon. By 7 months the tongue become more flexible and the infant can swallow the food in small lumps. The ability to sit without support allows the infant greater ability to manipulate food and to interact during feeding.

The introduction if solid foods to the infant's diet (sometimes called beikost) should begin with one single ingredient foods. The food should be given for 3-5 days before another is added. Slow introduction gives the infant time to become adjusted to the new tastes and permit parents to identify any negative reactions (allergy or intolerance) to a specific food. Repeated dietary exposure to the same food increases acceptance and behavior response to a new food. It outlines foods and amounts appropriate for many babies during the first year because iron reserves become depleted at 4-6 months, iron fortified infant cereals mixed with formula or breast milk is added first. The first cereal is usually iron fortified rice-cereal because it is least allergic cereal. Other cereals are introduced gradually with wheat and mixed cereals last. Single strained fruits, vegetables, meats and egg yolk are other early, food choices. Combination food such as strained cereal with fruit, vegetable with meat based dinners may be introduced after single ingredient foods are well tolerated.

Nutrient supplements are appropriate in some circumstances. Because the concentration concentration of vitamin D in human milk is low and inconsistent, breast fed infants may need supplemental vitamin D if the and infant have limited exposure to sun light. Full term exclusively breast fed infants usually maintain adequate iron status during the first six months of life due to mobilization of fetal iron stores and the high absorbability of iron in human milk. After that time infants should receive additional iron. Exclusively breast fed infants of mother who include no animal product in their diets may require supplement of vitamin B12. If the infant is weaned to soy based commercial infant formula, that formula will contain vitamin B12.

JUSTIFICATION

Appropriate nutrition practice plays a vital role in determining optimal health and development of infants. The current scenario of nutritional status of children and adolescence in the country is distributing, necessitating essential remedial measures. An optimal contributory factor to the prevalent situation is minimal involvement of trained pediatricians, nutritionalists and allied professionals in child nutrition and welfare activities. One of the most significant reasons for this study was to develop low cost, vale added weaning foods which are easy to prepare.

OBJECTIVES

1. To prepare value added weaning food products using flours of germinated cereals and pulses.
2. To find out the acceptance of prepared weaning foods.
3. To calculate the nutritive value of the prepared products.

MATERIALS AND METHODS

The details of materials, procedures followed have been elaborated under the following heads:

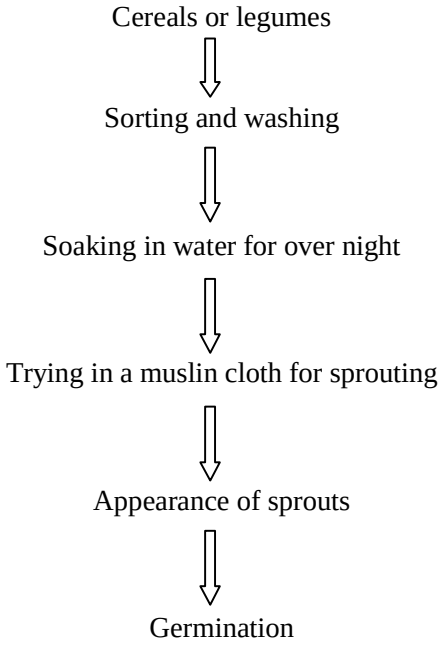
1. Procurement of raw materials.
2. Sprouting of cereals and pulses.
3. Dehydration of sprouts.
4. Treatment and replication of developed products.
5. Organoleptic evaluation
6. Analysis of the developed products.

PROCUREMENT OF RAW MATERIALS:

MOONG, WHEAT AND BAJRA- Cereals and pulses were purchased from the local market of Pratapgarh District.

OTHER INGREDIENTS- Other ingredients like oil, ghee, salt, sugar, milk and khoa were purchased from the local market of Pratapgarh district.

Sprouting of cereals and pulses:



Source : khader Vijaya, Textbook of Food Science and Technology, published by directorate of information and publication of agriculture ICAR.

Dehydration of sprouts

Taking germinated cereals and pulse

⇩

Spreading them in trays

⇩

Drying in oven at 180C for a hour

⇩

Repeating the process till moisture disappear

⇩

Dehydration

Preparation of flours

Taking dehydrated cereals and pulses

⇩

Grinding to a fine powder

⇩

Flours

Source: http://www.nutritionflash.com

3.4 Treatments And Replication Of Different Products Developed From Wheat Flour, Whole Moong Flour And Bajra Flour

Treatment of products	T_1			T_2			T_3			Replication
	WF	BF	MF	WF	BF	MF	WF	BF	MF	
Sweet porridge	60	20	20	20	70	10	20	15	65	5
Panjiri	60	20	20	20	70	10	20	15	65	5

WF- Wheat Flour
BF- Bajra flour
MF- Moong flour

WEANING FOOD/PRODUCT DEVELOPMENT OF PRODUCTS

Three flour based combination were i.e. wheat flour, Bajra and whole moong flour. Different ratios of these flour combination were tried several tried several times and evaluated by sensory evaluation method to obtain the best ratios. The three combinations respectively were then used as treatments (T_1, T_2, and T_3) for the development of two products i.e. Sweet Porridge, Panjiri.

ORGANOLEPTIC ANALYSIS

Sensory evaluation of the developed product was evaluated by 50 lactating mothers selected from among the several areas of Pratapgarh city for the sensory attributes of colours, appearance, texture, flavor, taste and overall acceptability by using Nine point hedonic scale score card. The samples were placed before the lactating mother with sample code T_1, T_2, T_3. The panel of lactating mothers graded the coded samples of the product.

ANALYSIS OF THE DEVELOPED PRODUCTS

The data obtained for various products were statistically analyzed by Analysis of Variance technique and critical difference test.

RESULT AND DISCUSSION

The data collected on different aspects as per the methodology have been tabulated and analyzed statistically. The findings also illustrated diagrammatically. The results obtained from the analysis were presented and discussed in the following sequence.

- Sensory characteristic of the developed products
- Nutrition composition of the products.

4.1 Comparision Between Constituent Of Germinated Grain Flour And Non Germinated Flours G/100 gm

Nutrients	Non germinated flours			Germinated flours		
	WF	BF	MF	WF	BF	MF
Protein (gm)	12.1	11.6	24	16.4	13.9	4.9
Carbohydrate (gm)	71.2	67.5	56.7	86.4	79.2	70.1
Calcium(mg)	41	42	75	56	58	96
Iron (mg)	5.3	8	3.9	7.2	9.8	4.8

WF- Wheat Flour
BF- Bajra flour
MF- Moong flour

Table 4.1 shows that the composition of germinated and non germinated grain flours. Rest of the nutrients and minerals increased simultaneously in germinated grain flour i.e. in wheat flour carbohydrate (86.4gm), protein (16.4 gm), calcium (56 mg), and iron (702 mg) in whole moong flour (100gm) carbohydrate (70.1 gm), protein (26.7 gm), calcium (96mg), iron (48mg) and in Bajra flour carbohydrate (79.2 gm), protein (13.9gm), calcium (58mg), iron (9.8 mg). The values obtained were comparable to the values reported by Gopalan.

4.2 SENSORY CHARACTERISTICS OF THE PRODUCTS

4.2.1 mean sensory scores of different parameters in treated sample of Panjiri

Treatments	Colour	Texture	Taste	Overall acceptability
T_1	8.84	8.64	7.32	8.64
T_2	7.8	7.76	7.72	7.77
T_3	8	8.12	7.64	8.15
F-test	S	S	S	S
CD	0.71	0.45	0.909	0.26

1. **Colour**

   a) F=18.47(2,8), significant, P≤0.05, CD=0.71

2. **Texture**

   a) a) F=37.8(2,8), significant, P≤0.05, CD=0.45

3. **Taste**

   a) F=13.5(2,8), significant, P≤0.05, CD=0.909

4. **Overall acceptability**

   a) F=19.79(2,8), significant, P≤0.05, CD=0.26

From the above table 4.2.1 it is obvious that treatment T_1 (8.4) had the highest score followed by T_3 (8) and T_2 (7.92) scored the least. It is concluded that T_1 accepted and preferred very much by the panel members while T_3 and T_2 was scored moderate showing that the incorporation of 60% wheat flour, 20% whole moong flour and 20% of Bajra flour improved the colour of Panjiri.

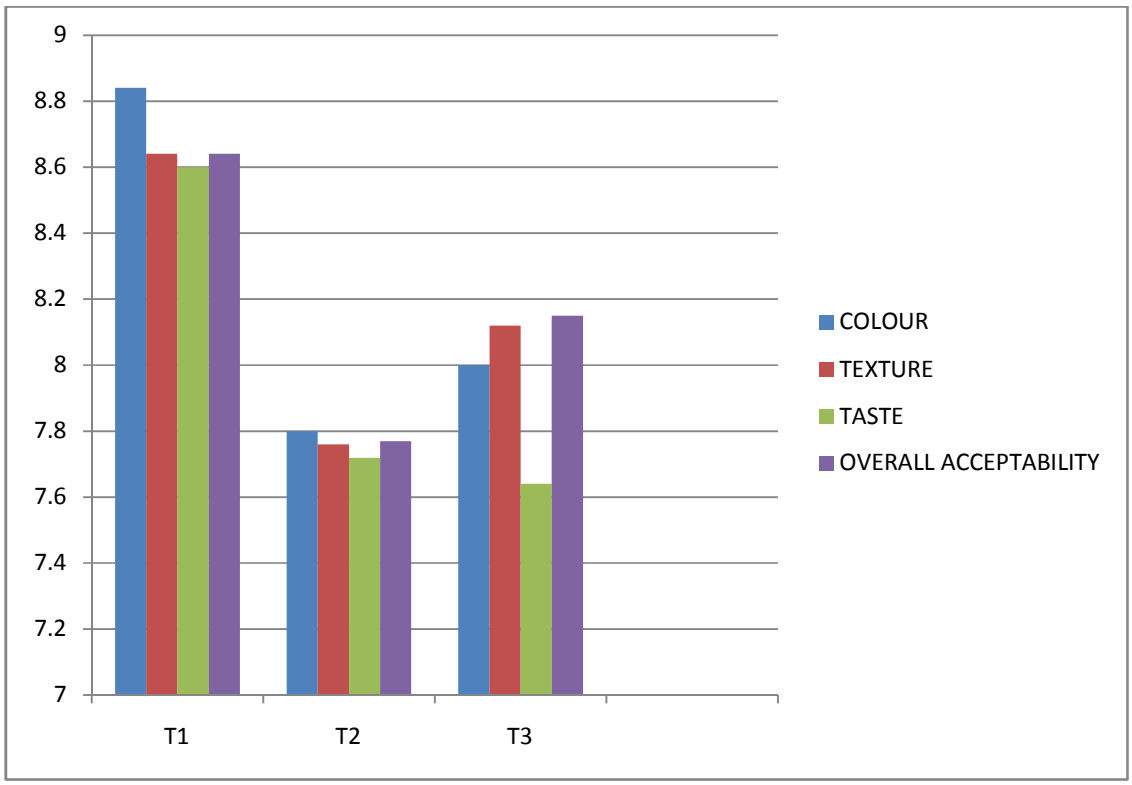
The ANOVA table showed a significant difference between the three variations of Panjiri for which CD test was applied to compare all the possible combination of two treatments means against the CD value.

It was observed that there were significant differences in the treatments i.e (T_1 and T_3), (T_1 and T_2) and non significant difference between (T_3 and T_2).

The data illustrated in the table 4.2.1 shows that the treatment T_1 held the maximum score (8.64) regarding the texture of Panjiri followed by T_3 (8.12) and T_2 (7.76) respectively. The table also shows that the mean of two treatments of Panjiri. To compare the possible combonation of two treatments regarding the taste, CD test has been applied. Difference between the mean of two treatments against the CD value shows that there was significant difference in treatment (T_1 and T_3), and non-significant differences in treatment (T_1 and T_2), (T_3 and T_2).

On comparing the mean score of all possible combination of two treatments at a time against CD value, the variations in mean scores differed significantly between all treatments (T_1 and T_3), (T_1 and T_2), (T_3 and T_2).

Mean Scores of Organoleptic attributes for treated samples of "Panjiri"



4.2.2 Mean Sensory Scores Of Different Parameters In Treated Sample Of Sweet Porridge

Treatments	Colour	Texture	Taste	Overall acceptability
T_1	7.48	7.32	7.7	7.53
T_2	7.8	7.8	7.4	7.54
T_3	8.2	8.16	8.32	8.3
F-test	S	S	S	NS
CD	0.93	0.66	1.11	-

1. **Colour**
   a) F=5.14(2,8), significant, P≤0.05, CD=0.93

2. **Texture**
   a) F=15.61(2,8), significant, P≤0.05, CD=0.66

3. **Taste**
   a) F=6.87(2,8), significant, P≤0.05, CD=0.11

4. **Overall acceptability**
   a) F=3.75(2,8), significant, P≤0.05

The data illustrated in the table 4.2.2 pertaining to the average sensory score on different parameters in treated samples of sweet porridge clearly shows that T_3 (8.2) had the highest score for the colour of sweet porridge followed by T_2(7.8), T_1(7.48). Therefore, it was concluded that treatment T_3(8.2) was preferred by the panel of lactating mothers indicating that incorporation of 20% wheat flour, 15% whole moong flour, 65% Bajra flour improved the colour of the product.

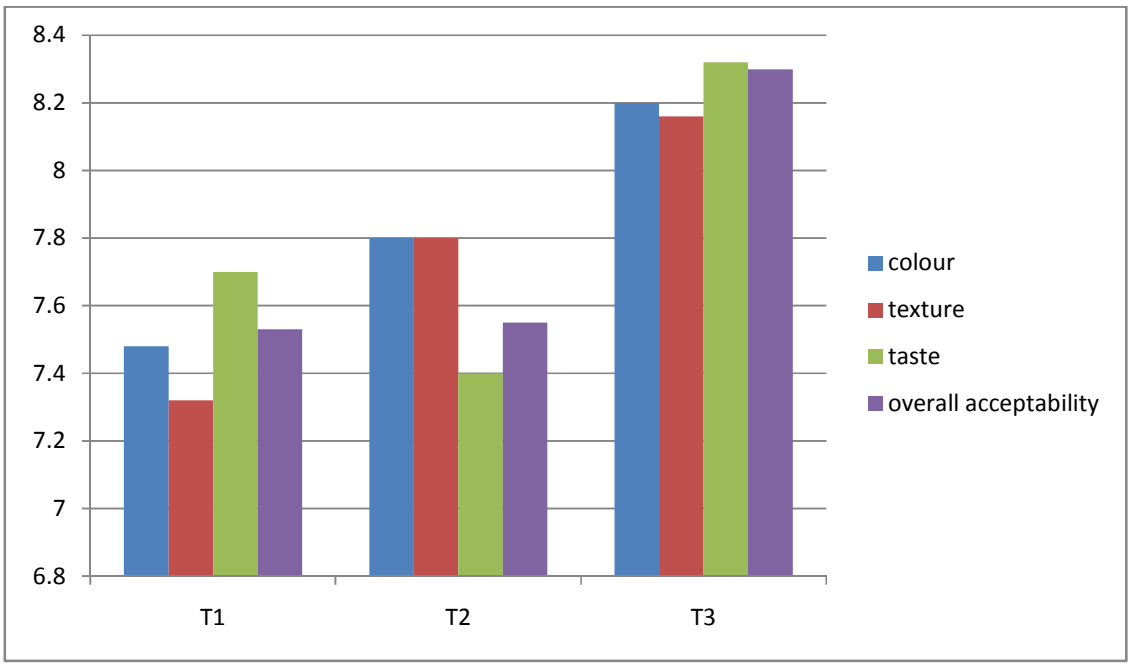
The table referred in show the calculated value of F to be greater than its table value signifying that there was a significant difference between the treatments of sweet porridge for which analysis CD test was applied.

The mean scores on the texture of sweet porridge from different treatments against CD value, the variations in scores shows significant difference between (T_3 and T_1) non significant difference were observed between, (T_3 and T_2)and (T_2 and T_1).

The mean scores on the texture of sweet porridge shows that treatment T_3 (8.16) scored the maximum marks followed by T_2 (7.8) and T_1 (7.32) respectively.

From the table, it is obvious that the calculated value of F is smaller than its table value on 2,8 d.f at 5% level of probably level. Therefore, it was conclude that difference were not significant between treatments regarding the overall acceptability of the product.

Mean scores of organoleptic attributes for treated samples of "Sweet Porridge"

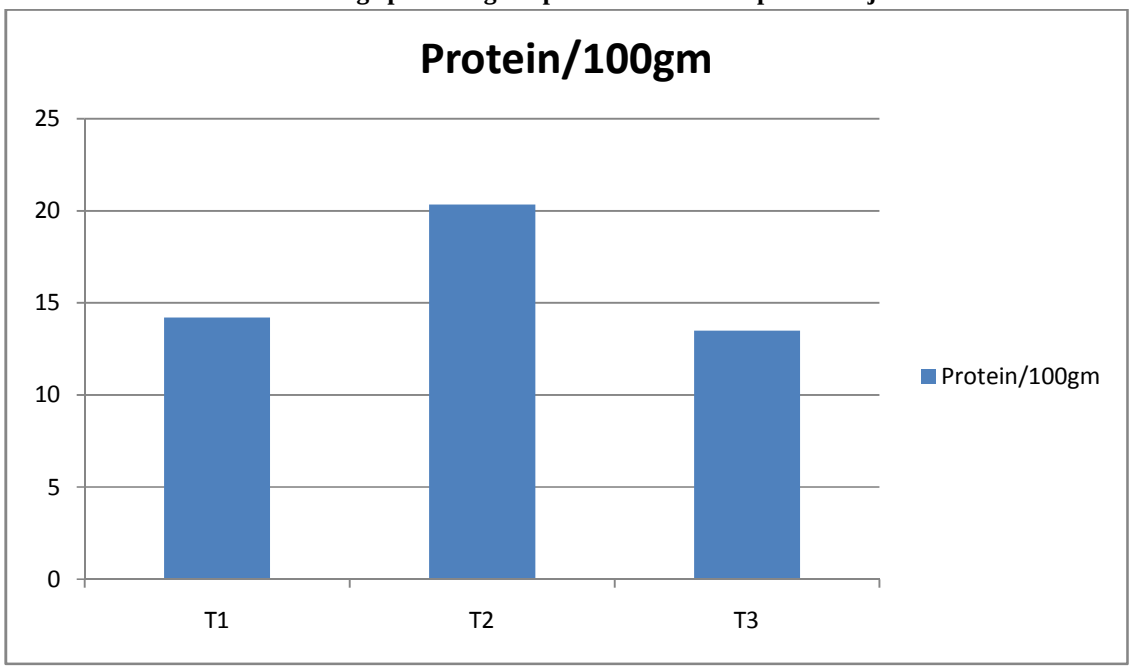


4.2.3 Average Percentage of Nutrients in Trial Samples of Panjiri

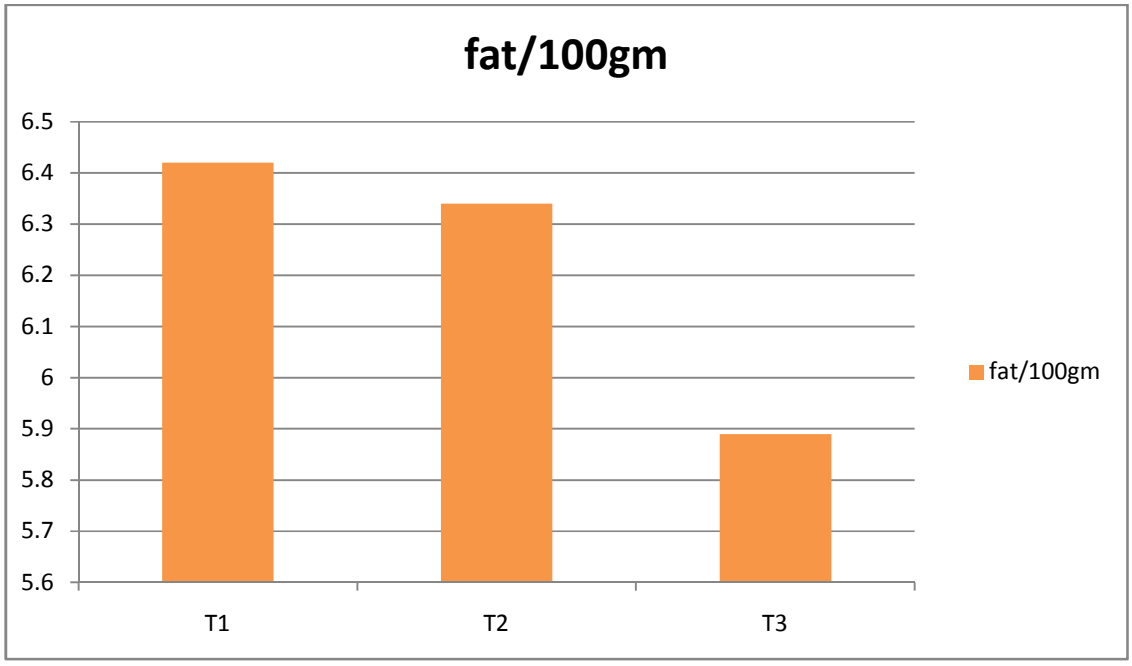
Treatment	Carbohydrate (gm)	Protein (gm)	Fat (gm)	Energy (kcal)	Calcium (mg)	Iron (mg)
T_1	**82.98**	14.2	**6.42**	**401.6**	46.2	5.53
T_2	75.8	**20.35**	6.34	396.6	51.2	**7.21**
T_3	**82.98**	13.5	5.89	397.7	**96.4**	5.23

The table shows that average nutritional composition of Panjiri with incorporation of germinated grain flours. In case of minerals calcium content varies but treatment T_3 had maximum calcium content and treatment T_2 had maximum iron content. The table also shows that the amount of carbohydrates, fat and energy is higher in T_1 and protein is highly presented in treatment T_2.

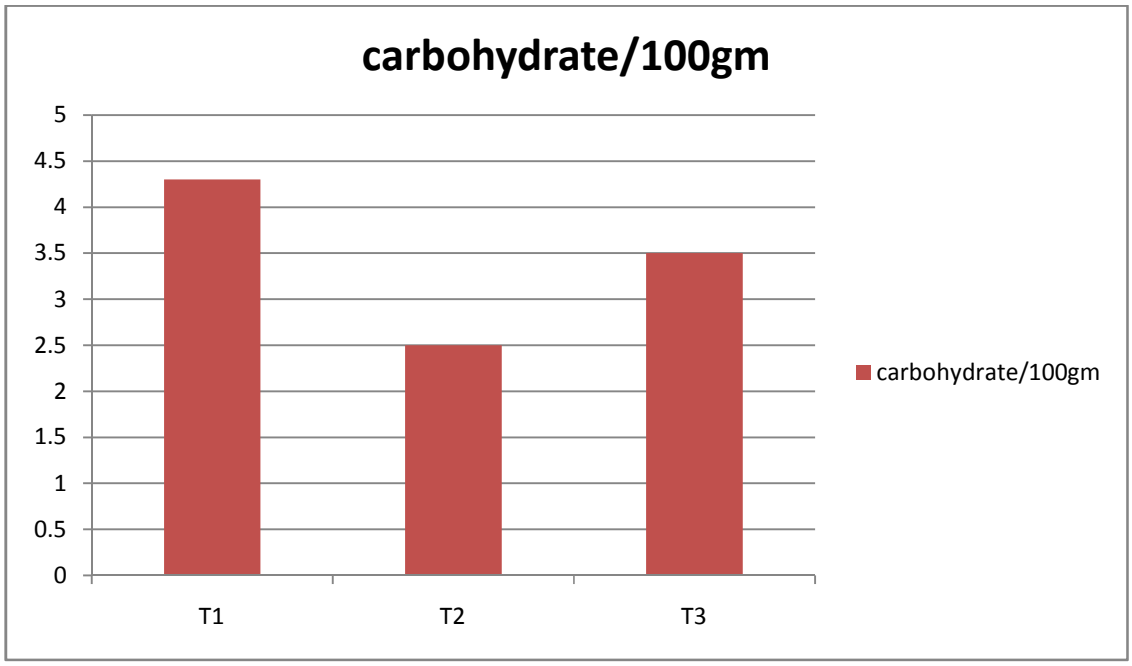
4.3.1 Average percentage of protein in trial sample of Panjiri



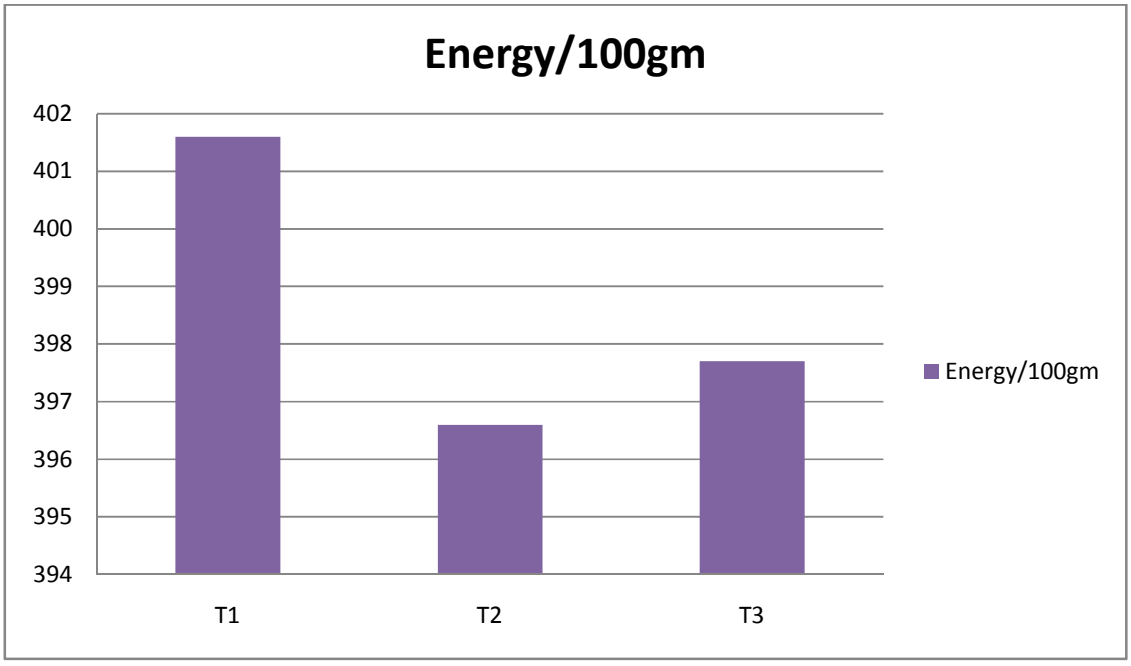
4.3.2 average percentage of fat in trial samples of Panjiri



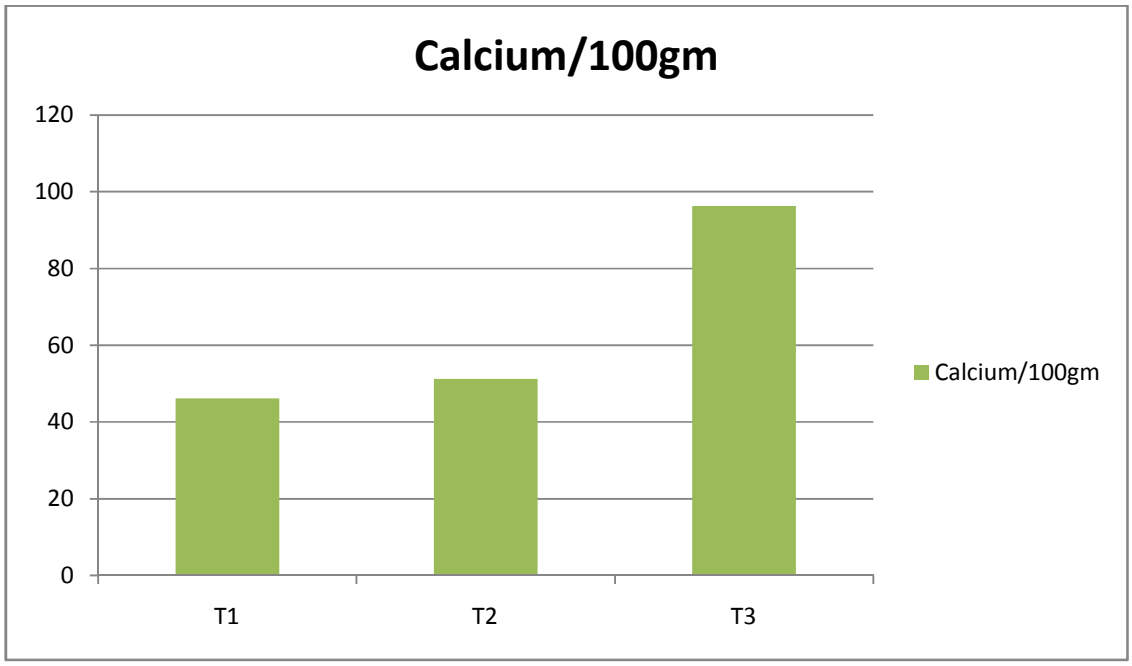
4.3.3 Average percentage of carbohydrates in trial samples of Panjiri



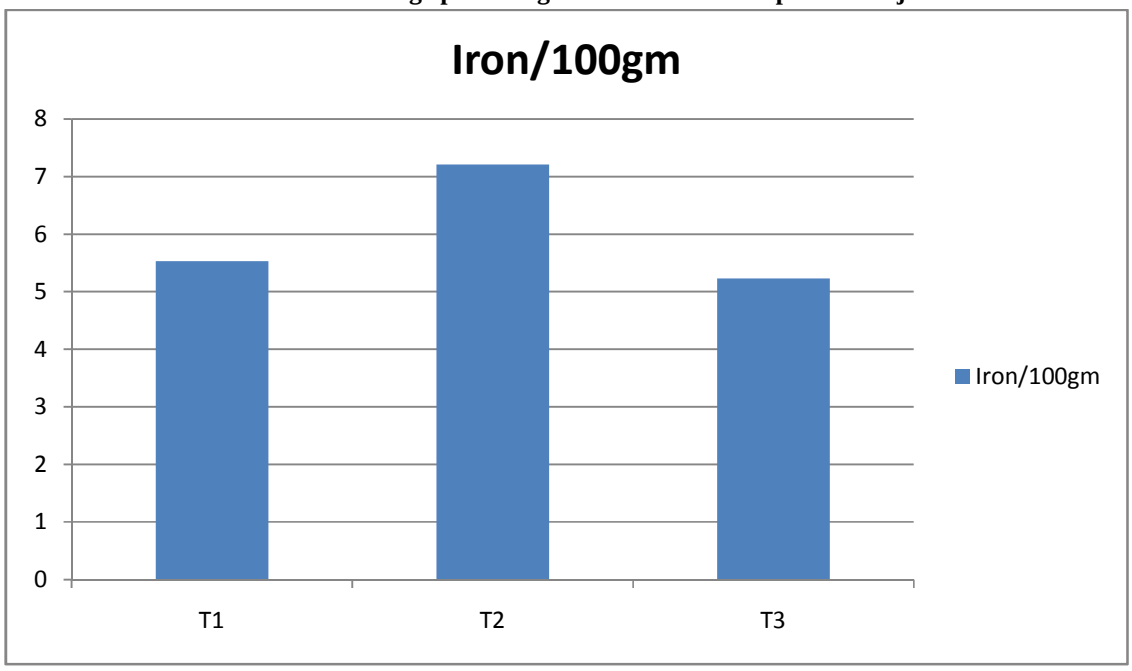
4.3.4 Average percentage of energy in trial samples of Panjiri



4.3.5 Average percentage of calcium in trial samples of Panjiri



4.3.6 Average percentage of iron in trial samples of Panjiri

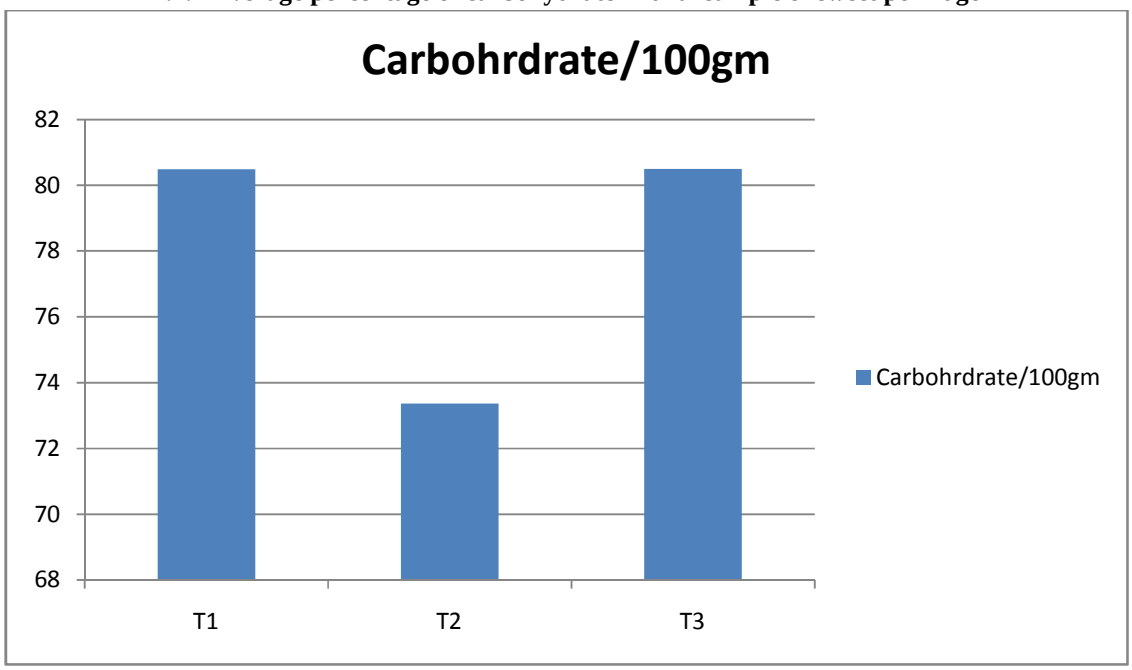


4.4 Average Percentage Of Nutrients in Trial Samples of "Sweet Porridge"

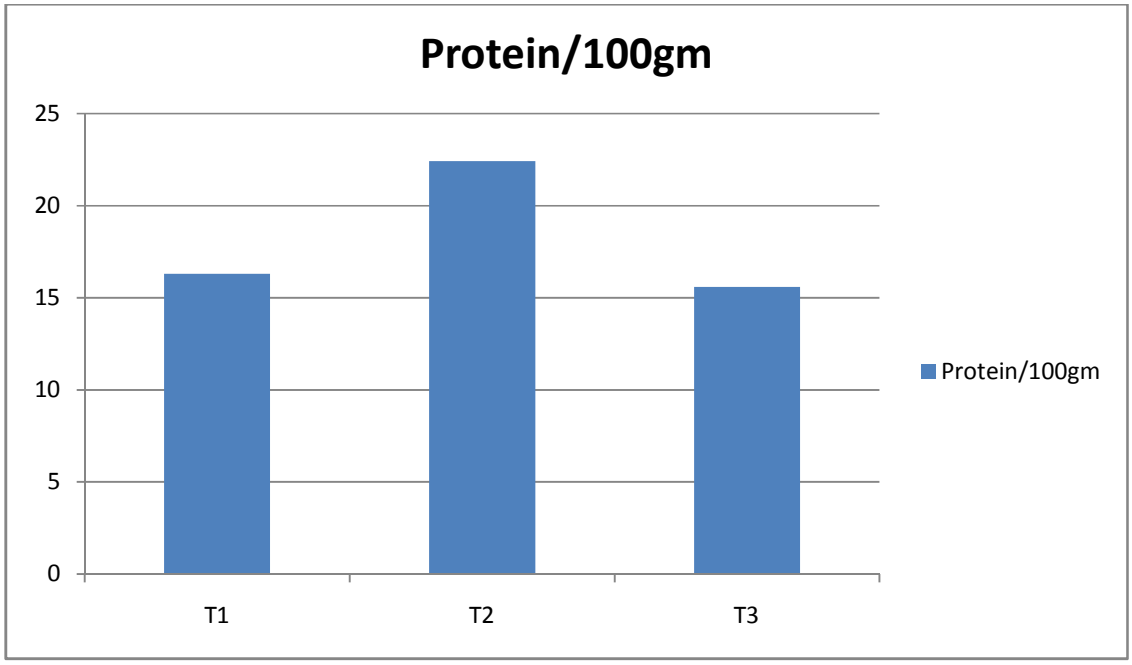
Treatment	Carbohydrate (gm)	Protein (gm)	Fat (gm)	Energy (kcal)	Calcium (mg)	Iron (mg)
T_1	80.48	16.3	**4.67**	**440.1**	255.6	5.59
T_2	73.36	**22.42**	4.59	405.1	260.6	**7.47**
T_3	**80.49**	15.6	4.58	436.2	**305.7**	5.49

The table shows the average nutritional composition of sweet porridge with incorporation of germinated grain flours. In case of minerals calcium content varys but treatment T_3 had maximum calcium content and treatment T_2 had maximum iron content. Content of fat and energy were higher in treatment T_1 and protein and iron content are higher in treatment T_2.

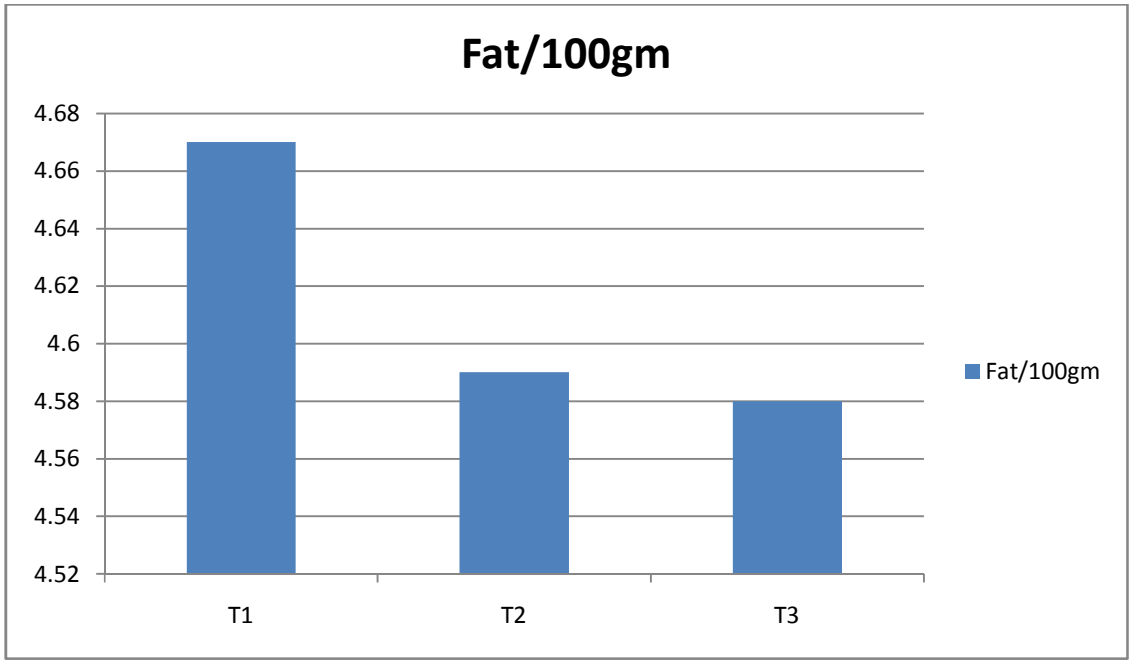
4.4.1 Average percentage of carbohydrate in trial sample of sweet porridge



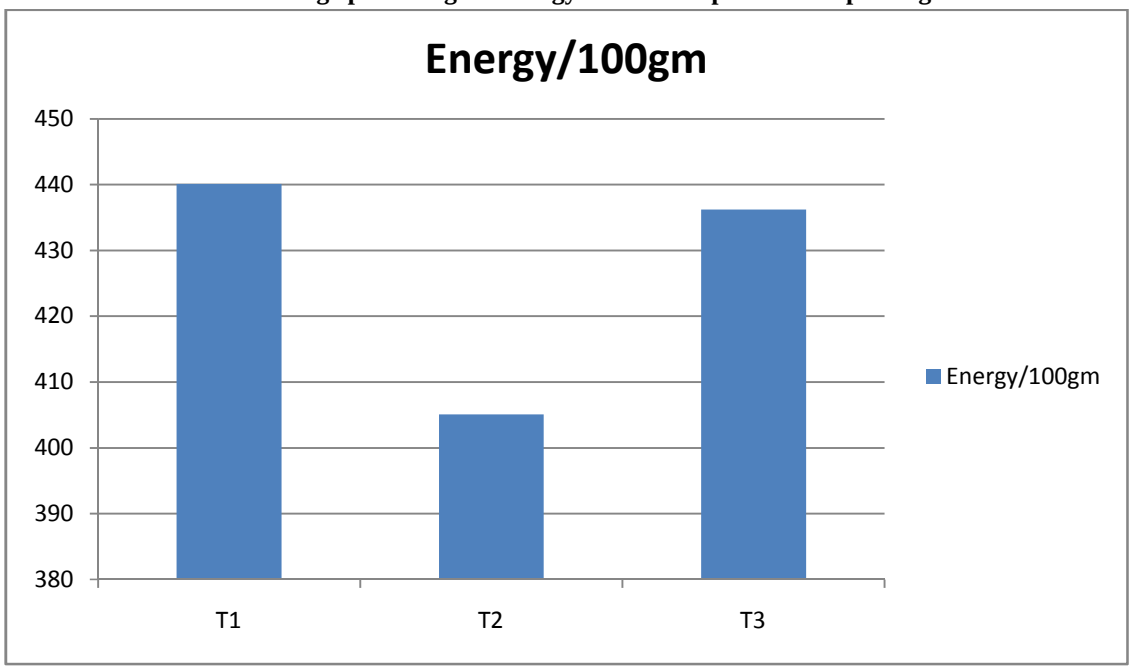
4.4.2 Average percentage of protein in trial sample of sweet porridge



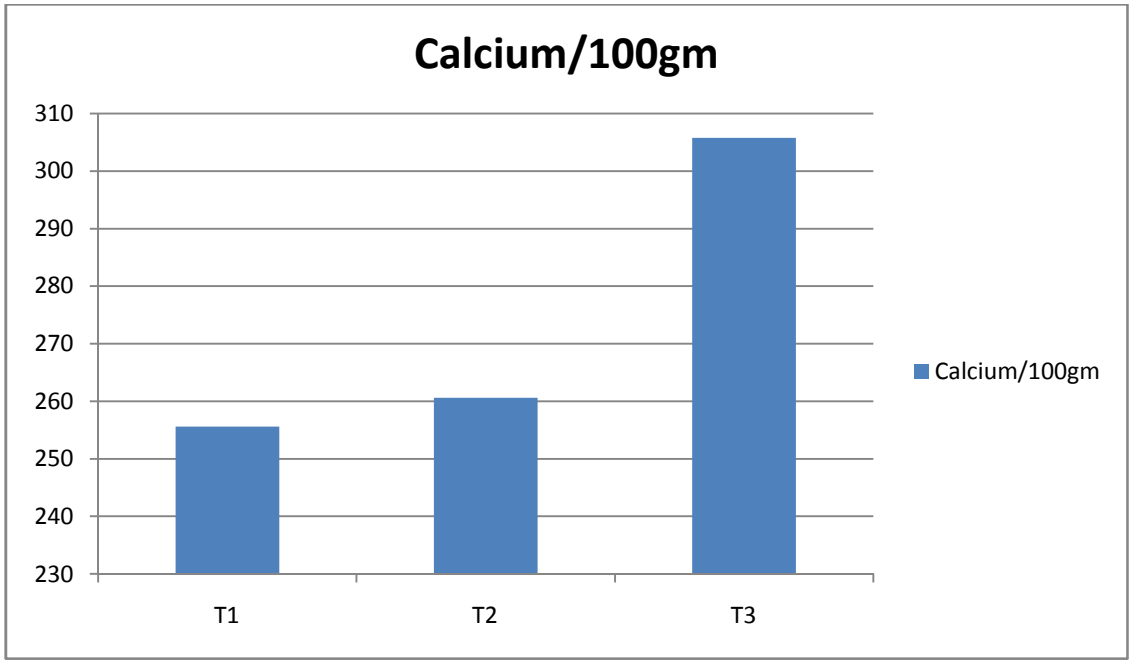
4.4.3 Average percentage of fat in trial sample of sweet porridge



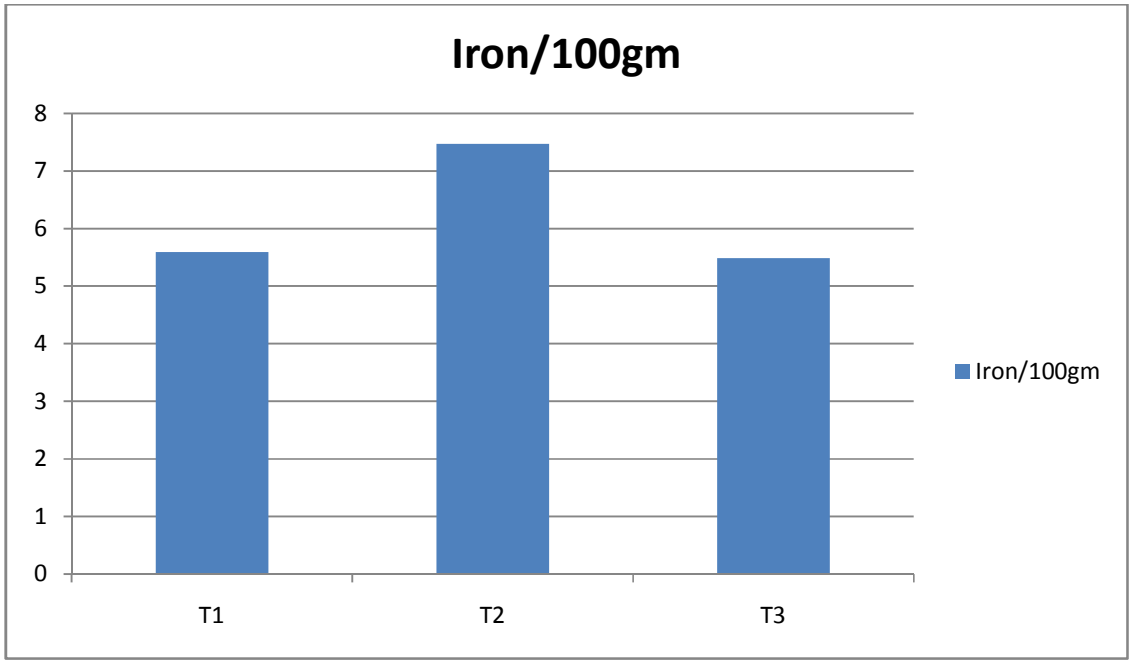
4.4.4 Average percentage of energy in trial sample of sweet porridge



4.4.5 Average percentage of calcium in trial sample of sweet porridge



4.4.6 Average percentage of iron in trial sample of sweet porridge



SUMMARY AND CONCLUSION

The present study entitled "Preparation of value added weaning food products using germinated flours of cereals and pulses" was carried out in order to find out the feasibility of incorporating Bajra flours, moong flour and wheat flour for the preparation of weaning foods; to determine the sensory evaluation of the prepared products and to calculate the nutrients of the developed products.

The Organoleptic analysis of the prepared products (sweet porridge, Panjiri) was conducted using the Nine- point hedonic scale. The nutritional composition of the products were calculated using the food composition Table.

Both of the products increased with the increase in the substitution levels in Panjiri and sweet porridge. Carbohydrate, energy, protein content to increased. Protein content is decreased only in T_1 and T_3 as the amount of moong flour was added only in small amount. In T_3 it increased gradually as the amount of whole green gram flour increased.

CONCLUSION

From the results summarized above, it was concluded that germinated grain flour can suitably be incorporated in weaning food products namely Panjiri and sweet porridge. Germinated flour provides concentrated form of nutrients (carbohydrates, energy and protein) in comparison to normal flour. The prepare products were accepted with regard to sensory characteristics. Treatment T_3 (20% wheat flour, 70% moong flour and 10% Bajra flour) scored in best in over all acceptability in sweet porridge, whereas treatment T_1 (60% wheat flour, 20% moong flour, 20% Bajra flour) scored the best in Panjiri. And treatment T_2 (20% wheat flour, 65% Bajra flour and 15% moong flour) scored same in both. The nutritional composition of carbohydrate, energy and protein increased with germination. Though protein value decreased in T_1 and T_3 in the developed products however it increased in T_2 showing overall best results.

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