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Nutritional Value and Sensory Properties of Cookies Prepared As Baby Foods for Post Weaning

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Abstract

This study aimed to prepare a product that is beloved for children (cookies) and is supported by certain nutrients (oats - chickpeas- lupin) which leads to raising the nutritional value of prepared cookies that provide children with their daily needs of different nutrients. Cookies are a light food that is beloved and attractive to children, which is characterized by fast eating, preparation and also characterized by the length of storage period and easy to strengthen with additions that increase its nutritional value.

Raw materials for the manufacture of cookies such as wheat flour are equipped to extract 72%, oatmeal, chickpea flour and thermos flour. Chemical analysis of raw materials has been carried out and some mineral elements have been estimated.

Then several transactions of cookies were prepared and manufactured - the first transaction using flour (control), the second treatment 50 wheat flour + 50 oatmeal flour, the third treatment 50 wheat flour + 25% oatmeal + 25% chickpeas flour, The fourth treatment is 50 wheat flour + 25% oatmeal + 25% thermos flour, 50 wheat flour + 20% oatmeal + 15% hummus flour + 15% thermos flour. The baking was made for manufactured cookies and after cooling they were wrapped and stored at room temperature for two months.

During storage, chemical analysis was performed, estimating some physical properties and sensory evaluation during storage zero, one and two months from the beginning of storage.

One of the results obtained found that there was a moral deficiency between transactions compared to the control treatment. There was no moral difference between Transaction 2 and Transaction 3. There was also no moral difference between Transaction 4 and Transaction 5. The obtained results in cookies prepared show that the crude protein ranged from 21.58 to 14.13%, ether extract ranged from 19.41to 21.68% and available carbohydrate content ranged from 50.89 to 65.37%.

Keywords: Cookies – Wheat flour – Chickpea – Lupin – Baby foods

Introduction

Cookies are widely accepted and consumed in nearly all parts of the world due to being ready to eat, affordable, having good nutritional qualities, a wide range of tastes and a long shelf life **(Turksoy and Özkaya, 2011).**

Olaoye *et al.* (2007) described cookies as nutritive snacks produced from unpalatable dough that is transformed into appetizing product through the application of heat in an oven. They are popular examples of bakery product of ready-to-eat snack that possess several attractive features including wide consumption, more convenient with long shelf-life and have the ability to serve as vehicles for important nutrient **(Ajibola *et al*., 2015)**. Cookies are chemically leavened product **(Al-Sayed, 2013).**

Cookies are important food snacks for children and adults. At present cookies are prepared from white flour which is inferior in quality and low in fiber content. For this reasons interest in research has been developed in increasing fiber content in the diet. In many countries, cookies are prepared with fortified or composite flour to increase its nutritive value (**Gonzalez *et al.*, 1991)**. Importance of bakery products has expanded especially the use of whole and natural grains and other natural ingredients (**Saranraj and Geetha, 2012)**.

Oats are an important cereal crop in the developing world and the most popularly cultivated. Oats have received considerable attention for their high content of dietary fibers, phytochemicals and nutritional value. Oats products are consumed as ingredients in baked foods or in porridge and considered as source of low cost protein with a protein content of 15 to 20% (dry matter basis) in de hulled oat grain (**Ryan *et al*., 2007).**

Oats are an excellent food for lowering cholesterol and reducing risk of heart disease because of the high soluble fiber content. It is believed that consumption of oats possesses various health benefits such as hypo cholesterolaemic and anti-cancerous properties. Owing to their high nutritional value, oat-based food products like breads, biscuits, cookies, breakfast cereals, flakes and infant food are gaining increasing consideration **(Dykes and Rooney, 2007)**.

Oats possess the highest protein level among cereals, typically ranging from 12% to 20% **(Mohamed *et al*., 2009)**.

Chickpea (*Cicer arietinum* L) has a high protein, mostly contains high levels of complex carbohydrates (low glycemic index), is rich in vitamins and minerals

and is relatively free from anti-nutritional factors **(Wood and Grusak, 2007)**. Chickpea proteins are considered a suitable source of dietary protein due to the excellent balance of essential amino acids composition **(Zhang *et al*., 2007)**.

Lupin flour is widely considered an excellent raw material for supplementing different food products owing to its high protein content **(Pollard *et al*., 2002 and Sironi *et al*., 2005)** and is largely used as eggs substitute, for example in cakes, pancakes, biscuits, or brioche **(Tronc, 1999)**, and bread **(Papavergou *et al*., 1999)**.

Tarasenko *et al.* (2017) searched that protein weight fraction in powdered lupine seeds is sufficiently high and equals to about 34-43%.Taking into account high value of powdered lupine seeds' protein components for human feeding.

Lupin flour can be incorporated into wheat flour to improve the nutritional value of the final products without detrimental effects on the quality **(Pollard *et al*., 2002)**. In general, the addition of up to 10% lupin flour improves water binding, texture, shelf-life, and aroma **(Martinéz-Villaluenga *et al.*, 2006).**

The phenolic content and composition of *L. angustifolius*, despite its weak antioxidant capacity, may have positive implications for reducing the risk of cardiovascular disease due to its protective effects on blood vessel health **(Ooman *et al*., 2006).**

This study aimed to prepare a product that is beloved for children (cookies) and is supported by certain nutrients (oats - chickpeas- lupin) which leads to raising the nutritional value of prepared cookies that provide children with their daily needs of various nutrients.

Materials and Methods

Materials:

Wheat flour (72% ext.), chickpea, oat flour, sweet lupin, skim milk, shortening, fresh egg, baking powder and vanilla were obtained from local supermarket, Tukh City, Qaliuobia , Egypt.

Preparation of chickpea and lupin flour:

Chickpea (*Cicer arietinum* L.) and lupin (*Lupinus spp*.) were sorted to remove foreign things. After that chickpea and lupin were washed with tap water and soaked in water at 1:10 (w/v) ratio for 12 hours, boiled in water for 1 hour, then, dried in an air ventilation oven at (55C°±5) until reached to constant weight and grounded to pass through 45 mesh sieve for produce chickpea seeds powder.

Preparation of cookies:

The preparation of cookies was done according to **A.A.C.C. (2000)** method.
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Table 1. Cookies formulas**:**

Ingredient(g)	T1 (Control)	T2	T3	T4	T5
Wheat flour (72% ext.)	**100**	**50**	**50**	**50**	**50**
Oat flour	**-**	**50**	**25**	**25**	**20**
Chickpea flour	**-**	**-**	**25**	**-**	**15**
Lupin flour	**-**	**-**	**-**	**25**	**15**
Shortening	**50**	**50**	**50**	**50**	**50**
Sugar	**40**	**40**	**40**	**40**	**40**
egg (whole)	**30**	**30**	**30**	**30**	**30**
Baking powder	**1**	**1**	**1**	**1**	**1**
Vanilla	**1**	**1**	**1**	**1**	**1**

Chemical analysis:

Moisture, protein, ether extract, crude fiber and ash contents were determined according to the method described in the **A.O.A.C. (2012)** and available carbohydrates were calculated by difference as equation:

Available carbohydrates = 100 – (% crude protein + % ether extract + % ash + % crude fiber).

Macro and micro-elements calcium, potassium, magnesium, zin and iron were determined using the atomic absorption spectroscopy technique (Pye Unicom Sp. 1900 England) as described by **A.O.A.C. (2012)**.

Texture profile analysis of produced cookies:

The hardness of the cookies was measured using a Texture Analyzer (Comtech, B type, Taiwan). A test speed of 1 mm/s was used for all tests. Three replicates of each formulation were conducted. Breaking strength. Cookies were broken using the three-point bending rig probe.The experimental conditions were supports: 50 mm apart and 20 mm probe travel distance. The force at break (N) was measured **(Bourne, 2003)**

Sensory evaluation of cookies:

Cookies were organoleptically evaluated for its sensory characteristics. Slice of each cookies sample was served using 12 panelists from the staff of the Food Tech. Res. Institute, Agric., Res. Center. Samples were scored according to **Larmond (1977).** Color (10), taste (10), odor (10), texture (10) and overall acceptability (40).

Statistical analysis

The Statistical analysis was carried out using ANOVA with two factors under significance level of 0.05 for the whole results using **SPSS (ver. 22).** Data were treated as complete randomization design according to **Steel *et al.* (1997).** Multiple comparisons were carried out applying LSD.

Results and Discussion

1. Chemical composition of raw materials:

Date presented in Table (1) shown that the chemical composition of raw materials used in this study as: moisture, crude protein, ether extract, ash, fiber and available carbohydrate.

Data presented in Table (1) shown that the wheat flour contained 11.95, 1.02, 0.97, 0.55 and 85.50% (on dry basis) of crude protein, ether extract, ash, crude fiber and available carbohydrate, respectively. The results are in agreement with those obtained by **Ally (2001)** who showed that the wheat flour contain 10.87-13.24% moisture, 10.95-13.07% protein, 0.098-2.22% fat, 0.43-1.083% ash, 0.31-3.38% fiber and 72.87-86.89% total carbohydrates.

Also, the oats flour contained 17.59, 5.37, 2.30, 7.54 and 67.20% (on dry basis) of crude protein, ether extract, ash, crude fiber and available carbohydrate, respectively.

While, the chickpea flour contained 35.23, 4.38, 3.25, 2.75and 54.38% (on dry basis) of crude protein, ether extract, ash, crude fiber and available carbohydrate, respectively.

On the other hand, the lupin flour contained 39.74, 5.58, 3.64, 14.94 and 36.10% of crude protein, ether extract, ash, crude fiber and available carbohydrate, respectively.

While, moisture content in wheat, oats, chickpea and lupin flour were 10.70, 8.75, 7.77 and 9.60% respectively.

The results are in agreement with those obtained by **Tarasenko *et al.* (2017)** who reported that protein contents in powdered lupin seeds are 34-43%.

The results are in agreement with those obtained by **Rybinski *et al.* (2018)** who found that the oil content in lupin seeds which ranges from 5.7 to 12.1%

Table 1. Chemical composition of raw materials (mean±SE)

Component	Wheat	Oats	Chickpea	Lupine
Moisture (%)	**10.70 ±0.06^{C}**	**8.75 ±0.07^{E}**	**7.77 ±0.30^{F}**	**9.60 ±0.09^{D}**
Protein* (%)	**11.95 ±0.12^{D}**	**17.59 ±0.06^{C}**	**35.23 ±0.21^{B}**	**39.74 ±0.11^{A}**
Ether extract* (%)	**1.02 ±0.01^{C}**	**5.37 ±0.07^{A}**	**4.38 ±0.04^{B}**	**5.58 ±0.19^{A}**
Ash* (%)	**0.97 ±0.43^{D}**	**2.30 ±0.11^{C}**	**3.25 ±0.10^{B}**	**3.64 ±0.11^{B}**
Fiber* (%)	**0.55 ±0.01^{E}**	**7.54 ±0.15^{C}**	**2.75 ±0.16^{D}**	**14.94 ±0.20^{A}**
Available carbohydrate*$^{@}$ (%)	**85.50 ±0.48^{B}**	**67.20 ±0.02^{D}**	**54.38 ±0.40^{E}**	**36.10 ±0.57^{F}**
Total caloric (kCal/100 g)	**399.00 ±1.51^{A}**	**387.50 ±0.38^{B}**	**397.91 ±1.00^{A}**	**353.60 ±1.66^{D}**

* (on dry weight basis) $^{@}$: Available carbohydrate calculated by difference

A, B & C: There is no significant difference (P>0.05) between any two means for the same attribute, within the same row have the same superscript letter.

Minerals content:

The obtained data of the some minerals content of raw materials are presented in Table (2).

The obtained data it is evident that the major minerals in wheat flour are K, Ca, Zn, Mg and Fe was 0.68, 0.47, 1.92, 137.00 and 3.86 mg/100 g,

respectively. Also, the major minerals in oats flour are K, Ca, Zn, Mg and Fe was 0.51, 0.25, 2.19, 109.00 and 3.36 mg/100 g, respectively. While, the major minerals in chickpea flour are K, Ca, Zn, Mg and Fe were 0.52, 0.22, 2.80, 262.00 and 2.50 mg/100 g, respectively. Also, the major minerals in lupin flour are K, Ca, Zn, Mg and Fe was 0.56, 0.22, 3.64, 197.00 and 2.26 mg/100 g, respectively.

These results are in agree with **El-Shimy (2013)**, who found that chickpea flour contain a remarkable amount of phosphorus, sodium, potassium, magnesium, and iron (325, 64, 82.5, 15.8 and 4.65 mg/100 g, respectively)

Table 2. Minerals content of flours (mg/100 g)

Element	Wheat	Oats	Chickpea	Lupin
K	**0.68**	**0.51**	**0.52**	**0.56**
Ca	**0.47**	**0.25**	**0.22**	**0.22**
Zn	**1.92**	**2.19**	**2.80**	**3.64**
Mg	**137.00**	**109.00**	**262.00**	**197.00**
Fe	**3.86**	**3.36**	**2.50**	**2.26**

Cookies:

Chemical composition of cookies:

Data in Table (3) shows that moisture content ranged from 4.54 to 6.13%, which was significant increase in T2, while it was significantly lower in T4. Statistical analysis indicated that a significant difference between all treatments in moisture content.

Statistical analysis indicated that there is no significant difference in moisture content by increasing the storage periods. Moisture content of cookies decreased in significantly from 5.09 to 5.08% by increasing the storage periods.

Also, crude protein ranged from 21.58 to 14.13%, which was significant increase in T5, while it was significantly lower in T1. Statistical analysis indicated that a significant difference between all treatments in moisture content.

Statistical analysis indicated that there is no significant difference in crud protein content by increasing the storage periods. Crud protein content of cookies decreased in significantly from 18.36 to 18.60% by increasing the storage periods (tow months).

Also, ether extract ranged from 19.41to 21.68%, which was significant increase in T2, while it was significantly lower in T1. Statistical analysis did not appear any significant difference in ether extract content between T2, T3, T4 and T5.

Statistical analysis indicated that there is no significant difference in ether extract content by increasing the storage periods .Ether extract content of cookies decreased in significantly from 21.19 to 21.08% by increasing the storage periods.

Furthermore, ash content ranged from 0.59 to 1.07%, which was significant increase in T5, while it was significantly lower in T1.Statistical analysis did not appear any significant difference in ash content between T2 and T5. There is also no significant difference between T3 and T4.

Statistical analysis indicated that there is no significant difference in ash content by increasing the storage periods. Statistical analysis indicated that a significant difference between all treatments. While, fiber content ranged from 0.50 to 5.54%, which was significant increase in T4, while it was significantly lower in T1.

Statistical analysis indicated that there is no significant difference in fiber content by increasing the storage periods. Fiber content of cookies decreased in significantly from 3.93 to 3.87% by increasing the storage periods.

On the other hand, available carbohydrate content ranged from 50.89 to 65.37%, which was significant increase in T1, while it was significantly lower in T4. Statistical analysis did not appear any significant difference in carbohydrate content between T4 and T5.

Statistical analysis indicated that there is no significant difference in available carbohydrate content by increasing the storage periods .available carbohydrate content of cookies increased in significantly from 55.33 to 55.55% by increasing the storage periods.

Table 3. Effect of storage period at room temperature on chemical composition of cookies (mean±SE).

Treatments	Storage period (month)			Mean of treatment
	0	1	2	
	Moisture (%)			
T1	**5.13±0.03^{bA}**	**5.14±0.31^{bA}**	**5.16±0.13^{bA}**	**5.14±0.10^{b}**
T2	**6.12±0.01^{aA}**	**6.13±0.13^{aA}**	**6.13±0.01^{aA}**	**6.13±0.04^{a}**
T3	**4.80±0.21^{cdA}**	**4.76±0.41^{cA}**	**4.76±0.09^{cA}**	**4.77±0.14^{cd}**
T4	**4.52±0.07^{dA}**	**4.55±0.07^{cA}**	**4.55±0.12^{cA}**	**4.54±0.04^{d}**
T5	**4.89±0.21^{bcA}**	**4.81±0.12^{cA}**	**4.82±0.06^{cA}**	**4.84±0.07^{c}**
Mean of storage period	**5.09±0.16^{A}**	**5.08±0.18^{A}**	**5.08±0.15^{A}**	

Crude protein* (%)				
T1	**14.15±0.32^{eA}**	**14.13±0.23^{eA}**	**14.11±0.14^{eA}**	**14.13±0.12^{e}**
T2	**16.14±0.03^{dA}**	**16.14±0.02^{dA}**	**16.13±0.03^{A}**	**16.14±0.01^{d}**
T3	**20.24±0.05^{cA}**	**20.21±0.10^{cA}**	**20.20±0.04^{cA}**	**20.22±0.04^{c}**
T4	**21.02±0.08^{bA}**	**21.01±0.10^{bA}**	**20.99±0.08^{bA}**	**21.01±0.04^{b}**
T5	**21.62±0.05^{aA}**	**21.56±0.05^{aA}**	**21.55±0.04^{aA}**	**21.58±0.02^{a}**
Mean of storage period	**18.63±0.79^{A}**	**18.61±0.79^{A}**	**18.6±0.79^{A}**	
Ether extract* (%)				
T1	**19.45±0.27^{bA}**	**19.44±0.35^{cA}**	**19.35±0.21^{bA}**	**19.41±0.14^{b}**
T2	**21.73±0.31^{aA}**	**21.71±0.21^{aA}**	**21.61±0.21^{aA}**	**21.68±0.13^{a}**
T3	**21.39±0.33^{aA}**	**21.38±0.16^{aA}**	**21.36±0.33^{aA}**	**21.38±0.14^{a}**
T4	**21.71±0.27^{aA}**	**21.69±0.19^{aA}**	**21.60±0.46^{aA}**	**21.67±0.16^{a}**
T5	**21.65±0.24^{aA}**	**21.17±0.19^{bA}**	**21.46±0.23^{aA}**	**21.43±0.13^{a}**
Mean of storage period	**21.19±0.26^{A}**	**21.08±0.24^{A}**	**21.08±0.26^{A}**	
Ash* (%)				
T1	**0.58±0.02^{cA}**	**0.59±0.02^{dA}**	**0.59±0.02^{cA}**	**0.59±0.01^{c}**
T2	**1.05±0.02^{aA}**	**1.04±0.02^{aA}**	**1.03±0.07^{aA}**	**1.04±0.02^{a}**
T3	**0.96±0.05^{bA}**	**0.96±0.06^{bA}**	**0.95±0.02^{bA}**	**0.96±0.02^{b}**
T4	**0.91±0.04^{bA}**	**0.89±0.03^{cA}**	**0.89±0.03^{bA}**	**0.90±0.02^{b}**
T5	**1.08±0.01^{aA}**	**1.07±0.05^{aA}**	**1.07±0.03^{aA}**	**1.07±0.02^{a}**
Mean of storage period	**0.91±0.05^{A}**	**0.91±0.05^{A}**	**0.91±0.05^{A}**	
Fiber* (%)				
T1	**0.50±0.00^{eA}**	**0.50±0.00^{eA}**	**0.50±0.01^{eA}**	**0.50±0.00^{e}**
T2	**3.95±0.18^{dA}**	**3.92±0.04^{dA}**	**3.86±0.19^{dA}**	**3.91±0.08^{d}**
T3	**5.10±0.16^{bA}**	**5.04±0.09^{bA}**	**5.00±0.11^{bA}**	**5.05±0.06^{b}**
T4	**5.57±0.17^{aA}**	**5.52±0.18^{aA}**	**5.53±0.27^{aA}**	**5.54±0.11^{a}**
T5	**4.53±0.34^{cA}**	**4.47±0.14^{cA}**	**4.46±0.18^{cA}**	**4.49±0.12^{c}**
Mean of storage period	**3.93±0.49^{A}**	**3.89±0.48^{A}**	**3.87±0.48^{A}**	
Available carbohydrate*$^{@}$ (%)				
T1	**65.32±0.35^{aA}**	**65.34±0.36^{aA}**	**65.45±0.24^{aA}**	**65.37±0.16^{a}**
T2	**57.14±0.53^{bA}**	**57.20±0.17^{bA}**	**57.38±0.37^{bA}**	**57.24±0.20^{b}**
T3	**52.31±0.30^{cA}**	**52.41±0.24^{cA}**	**52.47±0.42^{cA}**	**52.40±0.16^{c}**
T4	**50.78±0.05^{dA}**	**50.88±0.23^{eA}**	**50.99±0.60^{dA}**	**50.89±0.19^{d}**
T5	**51.12±0.61^{dAB}**	**51.72±0.12^{dA}**	**51.46±0.41^{dAB}**	**51.43±0.23^{d}**
Mean of storage period	**55.33±1.48^{A}**	**55.51±1.44^{A}**	**55.55±1.46^{A}**	

*: On dry weight basis). @: Available carbohydrate by difference

a, b & c: There is no significant difference (P>0.05) between any two means, within the same column have the same superscript letter.

A, B & C: There is no significant difference (P>0.05) between any two means for the same attribute, within the same row have the same superscript letter

T1: Control (100% wheat flour) T2: 50% wheat flour + 50% oat flour

T3: 50% wheat flour + 25% oat flour + 25% chickpea flour

T4: 50% wheat flour + 25% oat flour + 25% lupin flour

T5: 50% wheat flour + 20% oat flour + 15% chickpea flour + 15% lupin flour

Physical properties of cookies:

Data in Table (4) show the effect of storage period on hardness weight, diameter, thickness and spread ratio of cookies. Hardness ranged from 7.80 to 15.79 N which were significant increased in T3, while it was in significantly lower in T5.

Statistical analysis did not appear any significant difference in hardness between T2, T4 and T5. Statistical analysis indicated that there is no significant difference by increasing the storage periods.

Weight ranged from 19.87 to 22.23 g which were significant increased in T3, while it was in significantly lower in T4.

Statistical analysis did not appear any significant difference in weight between T1 and T5. Also there was no significant difference between T2 and T3. This could be because the 100% wheat flour had more gluten which is responsible for increased dough development and elasticity **(Badifu *et al.*, 2005)**.

Diameter ranged from 54.38 to 58.68 mm which were significant increased in T1, while it was in significantly lower in T2. Statistical analysis did not appear any significant difference in diameter between T3 and T4.

Thickness ranged from 15.22 to 16.70 mm which were significant increased in T5, while it was in significantly lower in T3. Statistical analysis did not

appear any significant difference in thickness between T1, T2 and T3.

Spread ratio ranged from 3.59 to 3.82 which were insignificant increased in T1, while it was in significantly lower in T5. Statistical analysis did not appear any significant difference in spread ratio between all treatments.

These results are in agree with **Turksoy and Özkaya (2011),** they reported that the addition of dietary fiber from various sources and substitutes had a negative effect on the width, thickness and spread ratio of the products.

Table 4. Physical properties of cookies (mean±SE).

Treatments	Physical properties				
	Hardness (N*)	Diameter (mm)	Weight (g)	Thickness (mm)	Spread Ratio
T1	**8.43^{ab}**	**54.81^{a}**	**20.90^{ab}**	**15.48^{b}**	**3.54^{a}**
T2	**8.43^{ab}**	**54.12^{a}**	**20.83^{ab}**	**15.11^{b}**	**3.58^{a}**
T3	**13.29^{a}**	**55.68^{a}**	**20.62^{ab}**	**15.06^{b}**	**3.70^{a}**
T4	**13.19^{a}**	**55.73^{a}**	**19.14^{b}**	**16.01^{ab}**	**3.76^{a}**
T5	**7.50^{b}**	**56.23^{a}**	**22.15^{a}**	**16.78^{a}**	**3.62^{a}**

a, b & c: There is no significant difference (P>0.05) between any two means, within the same column have the same superscript letter.

T1: Control (100% wheat flour)

T2: 50% wheat flour + 50% oat flour

T3: 50% wheat flour + 25% oat flour + 25% chickpea flour

T4: 50% wheat flour + 25% oat flour + 25% lupin flour

T5: 50% wheat flour + 20% oat flour + 15% chickpea flour + 15% lupin flour

Sensory evaluation of cookies

Data in Table (5) shows the changes in color score during storage period of cookies. Color property in cookies ranged from 8.38 to 9.45, which was significant increase in T1, while it was significantly lower in T4.

Statistical analysis did not appear any significant difference in color between T3 and T5, which contained 8.60 and 8.58 respectively. Statistical analysis indicated a significant difference in color by increasing the storage period. Color of cookies was decreased significantly from 9.07 to 8.44 by increasing the storage periods. Colour is a very important parameter in judging properly baked cookies that not only reflect the suitable raw materials used for the preparation but also provides information about the formulation and quality of the product **(Ikpeme *et al*., 2010)**.

Statistical analysis indicated that a significant differences in taste of cookies between the different treatments**.** Taste property in cookies ranged from 7.78 to 9.18, which was significant increase in T1, while it was significantly lower in T4. Statistical analysis indicated a significant difference in taste by increasing the storage period. Taste of cookies was decreased significantly from 8.96 to 7.89 by increasing the storage periods.

Odor property in cookies ranged from 7.82 to 9.20, which was significant increase in T1, while it was significantly lower in T5.

Statistical analysis did not appear any significant difference in odor between T2 and T3. There is also no significant difference between T4 and T5. Statistical analysis indicated a significant difference in odor by increasing the storage period. Oder of cookies was decreased significantly from 8.95 to 7.84 by increasing the storage periods.

Texture property in cookies ranged from 7.45 to 9.07, which was significant increase in T1, while it was significantly lower in T5.

Statistical analysis did not appear any significant difference in texture between T2 and T3. There is also no significant difference between T4 and T5. Statistical analysis indicated a significant difference in texture by increasing the storage period. Texture of cookies was decreased significantly from 8.66 to 7.91 by increasing the storage periods.

Overall acceptability property in cookies ranged from 31.87 to 36.90, which was significant increase in T1, while it was significantly lower in T5.

Statistical analysis did not appear any significant difference in overall acceptability between T2 and T3. There is also no significant difference between T4 and T5.

Statistical analysis indicated a significant difference in overall acceptability by increasing the storage period. Overall acceptability of cookies was decreased significantly from 35.64 to 32.08 by increasing the storage periods.

Table 5. Effect of storage period at room temperature on sensory evaluation of cookies (mean±SE).

Treatment	Storage period (month)			Mean of treatment
	0	1	2	
		Color		
T1	**9.65±0.18^{aA}**	**9.50±0.24^{aA}**	**9.20±0.24^{aB}**	**9.45±0.13^{a}**
T2	**9.30±0.15^{aA}**	**8.80±0.17^{bB}**	**8.30±0.15^{bC}**	**8.80±0.12^{b}**
T3	**8.90±0.26^{bA}**	**8.60±0.28^{bcB}**	**8.30±0.29^{bC}**	**8.60±0.16^{bc}**
T4	**8.70±0.20^{bA}**	**8.40±0.22^{cB}**	**8.05±0.26^{bC}**	**8.38±0.14^{c}**
T5	**8.80±0.26^{bA}**	**8.60±0.19^{bcAB}**	**8.35±0.24^{bB}**	**8.58±0.13^{bc}**
Mean of storage period	**9.07±0.10^{A}**	**8.78±0.11^{B}**	**8.44±0.12^{C}**	
		Taste		
T1	**9.65±0.18^{aA}**	**9.05±0.22^{aB}**	**8.85±0.26^{aB}**	**9.18±0.14^{a}**
T2	**9.15±0.27^{bA}**	**8.60±0.30^{aB}**	**8.00±0.22^{bC}**	**8.58±0.17^{b}**
T3	**9.00±0.29^{bcA}**	**8.05±0.28^{bB}**	**7.65±0.18^{bC}**	**8.23±0.18^{bc}**
T4	**8.55±0.35^{cA}**	**7.55±0.29^{cB}**	**7.25±0.45^{cB}**	**7.78±0.23^{c}**
T5	**8.45±0.35^{cA}**	**7.90±0.29^{bcB}**	**7.70±0.27^{bcB}**	**8.02±0.18^{c}**
Mean of storage period	**8.96±0.14^{A}**	**8.23±0.14^{B}**	**7.89±0.15^{B}**	
		Odor		
T1	**9.55±0.19^{aA}**	**9.30±0.21^{aA}**	**8.75±0.27^{aB}**	**9.20±0.14^{a}**
T2	**9.15±0.32^{aA}**	**8.50±0.26^{bB}**	**8.15±0.17^{bC}**	**8.60±0.16^{b}**
T3	**9.20±0.24^{aA}**	**8.60±0.30^{bB}**	**7.65±0.24^{cC}**	**8.48±0.19^{b}**
T4	**8.45±0.30^{bA}**	**8.05±0.23^{cB}**	**7.50±0.17^{cdC}**	**8.00±0.15^{c}**
T5	**8.40±0.38^{bA}**	**7.90±0.19^{cB}**	**7.15±0.32^{dC}**	**7.82±0.20^{c}**
Mean of storage period	**8.95±0.14^{A}**	**8.47±0.12^{B}**	**7.84±0.13^{C}**	
		Texture		
T1	**9.45±0.19^{aA}**	**9.10±0.28^{aB}**	**8.65±0.32^{aC}**	**9.07±0.16^{a}**
T2	**8.90±0.22^{bA}**	**8.40±0.26^{bB}**	**8.10±0.34^{bB}**	**8.47±0.17^{b}**
T3	**8.80±0.24^{bA}**	**8.10±0.34^{bcB}**	**8.10±0.38^{bB}**	**8.33±0.19^{b}**
T4	**8.25±0.30^{cA}**	**7.70±0.23^{cdB}**	**7.60±0.22^{cB}**	**7.85±0.15^{c}**
T5	**7.90±0.27^{cA}**	**7.35±0.22^{dB}**	**7.10±0.19^{dB}**	**7.45±0.14^{c}**
Mean of storage period	**8.66±0.13^{A}**	**8.13±0.14^{B}**	**7.91±0.15^{B}**	
		Overall acceptability		
T1	**38.30±0.65^{aA}**	**36.95±0.80^{aB}**	**35.45±0.96^{aC}**	**36.90±0.50^{a}**
T2	**36.50±0.80^{bA}**	**34.30±0.80^{bB}**	**32.55±0.73^{bC}**	**34.45±0.53^{b}**
T3	**35.90±0.83^{bA}**	**33.35±0.88^{bB}**	**31.70±0.84^{bC}**	**33.65±0.57^{b}**
T4	**33.95±0.90^{cA}**	**31.70±0.79^{cB}**	**30.40±0.95^{cC}**	**32.02±0.56^{c}**
T5	**33.55±0.89^{cA}**	**31.75±0.51^{cB}**	**30.30±0.62^{cC}**	**31.87±0.46^{c}**
Mean of storage period	**35.64±0.43^{A}**	**33.61±0.43^{B}**	**32.08±0.45^{C}**	

a, b & c: There is no significant difference (P>0.05) between any two means, within the same column have the same superscript letter.

A, B & C: There is no significant difference (P>0.05) between any two means for the same attribute, within the same row have the same superscript letter

T1: Control (100% wheat flour)

T: 50% wheat flour + 50% oat flour

T3: 50% wheat flour + 25% oat flour + 25% chickpea flour

T4: 50% wheat flour + 25% oat flour + 25% lupin flour

T5: 50% wheat flour + 20% oat flour + 15% chickpea flour + 15% lupin flour

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القيمة الغذائية والخصائص الحسية للكوكيز المعد كأغذية للأطفال بعد الفطام

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تهدف الدراسة إلى إعداد منتج محبب للأطفال (الكوكيز) ومدعم ببعض المواد الغذائية (الحمص – الترمس – الشوفان) مما يؤدى الى رفع القيمة الغذائية للكوكيز المعد والذى يمد الأطفال باحتياجاتهم اليومية من العناصر الغذائية المختلفة.

ويعتبر الكوكيز من الأغذية الخفيفة المحببة والجاذبة للأطفال والذي يتميز بأنه سريع في الأكل والتحضير ويتميز أيضا بطول فترة التخزين كما يسهل تدعيمه بإضافات ترفع من قيمته الغذائية .

تم تجهيز المواد الخام اللازمة لتصنيع الكوكيز مثل دقيق القمح استخلاص 72%، دقيق الشوفان، دقيق الحمص ودقيق الترمس. وقد تم إجراء التحليل الكيميائى للمواد الخام وتقدير بعض العناصر المعدنية.

ثم تم إعداد وتصنيع عدة معاملات من الكوكيز – المعاملة الأولى باستخدام الدقيق (كنترول)، المعاملة الثانية 50 دقيق قمح + 50 دقيق شوفان، المعاملة الثالثة 50 دقيق قمح + 25% دقيق شوفان + 25% دقيق حمص، المعاملة الرابعة 50 دقيق قمح + 25% دقيق شوفان + 25% دقيق ترمس المعاملة الخامسة 50 دقيق قمح + 20% دقيق شوفان + 15% دقيق حمص + 15% دقيق ترمس. وتم الخبيز للكوكيز المصنعة وبعد تبريدها تم تغليفها وتخزينها على درجة حرارة الغرفة لمدة شهرين.

أثناء التخزين تم إجراء التحليل الكيميائى، تقدير بعض الخواص الفيزيائية والتقيم الحسى أثناء التخزين صفر، شهر وشهران من بداية التخزين. ومن النتائج المتحصل عليها وجد أن هناك نقص معنوى بين المعاملات مقارنة بمعاملة الكنترول. بينما لم يوجد فرق معنوى بين المعاملة رقم 2 والمعاملة رقم 3. كذلك لم يوجد فرق معنوى بين المعاملة رقم 4 المعاملة رقم 5. أظهرت النتائج المتحصل عليها في ملفات تعريف الارتباط المحضرة أن البروتين الخام تراوح من 21.58 إلى 14.13٪ ، ومستخلص الأثير تراوح من 19.41 إلى 21.68٪ ومحتوى الكربوهيدرات المتاح تراوح من 50.89 إلى 65.37٪.

الكلمات الكاشفة: الكوكيز – أغذية أطفال ما بعد الفطام – الشوفان – الحمص – الترمس.