Egypt. J. Agric. Res., 78 (1), 2000

CHEMICAL AND PHYSICAL CHARACTERSTICS OF WEANING FOODS PREPARED FROM CEREALS AND LEGUMES

ISMAIL, F.A.[1], GALAL, F.S.[1],
EL-ATAWY,Y.S[1] AND BAKRY, A.A.[2]

1. Faculty of Agriculture, Cairo Unversity, Egypt.
2. Food Technology Research Institute, Agriculture Research Center, Giza, Egypt.

(Manuscript received 1 October 1998)

ABSTRACT

Weaning foods (blends and cookies) were prepared from wheat flour of 72% extracton, corn flour, mung bean flour and dried skimmed milk. Some antinutritonal factors were removed from the used materals such as phytic aciid, tannin and trypsin inhibtor by some treatments, i.e, soaking in alkali, soaking in de-ionized water, germination and extrusion. Protein content of prepared weaning foods ranged from 15.1% to 22%. Ether extract ranged from 1.3% to 16.5%, Ash content from 1.4% to 2.9%. Carbohydrates content ranged from 63.7% to 77.8%. Fiber content ranged from 0.9% to 1.9%. Weanng foods were rich in minerals such as Ca, K, Fe, Se and Mn. Essential Faty acds; linoleic and linolenic were present in all blends while arachidonic acid was present only in the blends of soy bean and mung bean which also contained the other essential fatty acids. Low peroxide values were recorded during the 6 months of storage perod. The physical properties of weaning foods were considered suitable. Organoleptc characteristics were accetable during the storage period.

INTRODUCTION

The term weaning has been defned as a process by which the infant gradually becomes accustomed to the full diet (Cameron and Hofander 1983).

Liener (1980) found that phytic acid was known to interfere with the availability of various minerals including zinc, manganese, copper, molybdenum, calcium, magnesium, and iron. Most of these effects were observed in diets containing soy protein isolates and could be eliminated effectively by autoclaving or by adding chelating agents.

Lilianu and Marai (1985) reported that germination decreased the phytic acid content of rapeseed. The germ.nation for 2 days increased the protein 4% and 10% after 7 days of germnation. They found that germinaton for 2 days increased the fat 6%.

King and Puwastien (1987) found that protein content of legumes increased during germnation. They noticed depletion of oil in germinating legumes. The stored carbohydrates in seeds were utilized during early stages of germination. Germinaton reduced antinuritional factors such as trypsin inhbitors in soy bean and in navy bean. Cystne increased with a high level of significance. As germnation progressed the levels of aspartic acid and histidine increased signficantly. The increase in histidine and cystine, common constituents of many enzymes, might be expected durng germination when a consderable amounts of enzyme synthesis occurs.

Chavan *et al.*, (1979) noticed that soaking of sorghum seeds at 30°C in 0.05 M sodium hydroxide and potassium hydroxide removed 75.85% of the tannins in 24 hr. Treatment at 100°C increased the rate of extraction of cooked starches and increased water absorption and water solubility upon dispersion in cold water, this leads to "instant starch slurries" without heating. Their functional properties are highly dependent upon the cooking and drying conditions. Their results also showed that the effect of extrusion cooking on starch must not be interpreted only in terms of gelatinization (physical transformation), but also of macromolecular transformatons of both amylose and amylopectin. Such information is necessary for the understandng of the relation between the physical and chemical structures of thermally modified starches and their rheological and nutritional properties (Colonna *et al.*, 1984).

MATERIALS AND METHODS

To remove tannins, barley and sorghum were cleaned, washed and soaked in potassum hydroxide solution 0.05 M at 50°C for 12 hr. and washed with distilled water several times, according to the method of Chavan *et al.*, (1979).

To remove phytate the grains were presoaked in deionized water for 15 hrs. at 37°C then dried in hot air oven at 55°C for 20 hrs., then grined and soaked in water for 15 hr at 55°C and drained through mosulin cloth, dried at 55°C over night and sieved using sieve of 40 mesh as mentioned by satter *et al.*, (1989).

Mung bean, Chickpeas and soy bean were cleaned, washed and germinated by soaking in water for 72 hrs. according to Marero *et al.*, (1988). Gerrninated mung bean and germinated soy bean were husked by hand in running water. Mung bean, chickpeas and soy bean were dried at 55°C for 12 hr. and milled using a laboratory mill. All flours were passed through a 40 mesh screen. Each prepared flour was extruded by using Brabender laboratory extruder.12 formulas were used for the extruded cereals and legumes with the addition of 8% skimmed milk as shown in table 1.

Table 1. Formulation of weaning food blends.

Blend No.	Contents/100 g blend								
	Wheat	Corn	Rice	Barley	Sorghum	Soy bean	Chick-peas	Mung bean	Skimmed milk poweder
1	34.4	30.0	-	-		13.1	-	14.5	8.0
2	30%	-	-	-	34.4	13.1	-	14.5	8.0
3	34.4	30.0	-	-	-	-	13.1	14.5	8.0
4	-	-	34.4	30.0	-	-	13.1	14.5	8.0
5	-	-	34.4		30.0	13.1		14.5	8.0
6	-	-	34.4	30.0	-	13.1	-	14.5	8.0
7	34.4	30.0	-	-	-	13.1	14.5	-	8.0
8	30.0	-	-		34.4	13.1	14.5	-	8.0
9	-	-	34.4	-	30.0	13.1	14.5	-	8.0
10	-	-	34.4	30.0	-	13.1	14.5	-	8.0
11	30.0	-	-	-	34.4	-	13.1	14.5	8.0
12	-	-	34.4	30.0	-	13.1	14.5	14.5	8.0

Formula of cookies were prepared by adding 50g of the extruded blend to 50g. of wheat flour, 72% extraction· 25ml water, 25g sucrose, 15 ml corn oil, 2g baking powder and 0.03 g. vanilin.

The samples of blends and cookies were stored in polyethylene bags at room temperature (25-28^{O}C) for six months. Every month sensory evaluation was carried out.

Moisture, protein, ether extract, crude fiber and ash contents of samples were determined according to the Official Methods of Analysis (A.O.A.C. 1990). Total carbohydrates were estimated by difference.

Tannin was determined in sorghum and barley as row materals after different treatments colorimetrcally by vanillin method according to Burns (1971).

Phytic acid determinaton was carried out using a direct spectrophotometric method according to Mohamed *et al.*, (1986).

Trypsin inhibitor activity was determined using the casein digeston method described by Kakade *et al.*, (1969).

Trypsin in hibiror,TI content was calculated on the basis that 1.9 TIU is equvelent to one µg of TI. (Rackis 1981).

Fatty acids were deermined according to Becker *et al.*, (1981). Peroxide value was determned according to AOAC (1990).

Water absorption index (grams of gel recovered per gram of dry sample) and water solublity index (percent of dry sample in water layer) were determined according to Mercier and Feillet (1975).

Water retention was measured according to Bressani et al., (1978) viscosity was measured according to Peplinski & Pfeiter (1970) using a Barbender vscoamylograph.

The organoleptic charact·ristics of the blends and cookies are shown in table 2 according to AACC (1983). Twelve panelists were chosen from a group of mothers with weaned infants. They were asked to evaluate the organoleptic characteristics of the prepared weaning formulae (after standard mixing with water as mentoned above) and weaning cookies (coded samples were evaluated according to the score presented in table (2).

Table 2. Organoleptic characterisics of cookie blends.

Characteristics	Characteristics
Appearance	10
Texture	10
Colour	10
Flavour (oder + taste)	20
Total score	50

RESULTS AND DISCUSSION

The chemical compositon of the prepared weaning blends is shown in table 3. It could be noticed that moisture content were low, it ranged from 6.4 to 7.4%. Protein content were high and ranged between 17.1% and 22.0%. Blend (2) demonstrated the highest percentage of protein (22%). This could be atributed to the presence of soy bean and mung bean. The lowest percentage of protien was recorded for blend (4) (17.1%), which contained rice, barley, chickpeas and mung bean. Ether extract content in weaning blends recorded low values, it ranged from 1.3% to 2.3%. This may be attributed to the use of cereals and legumes and skim milk which are low in fat. The lowest percentage of ether extract is notced for blend (12). This blend contained rice, chickpeas and mung bean which contain low percentage of ether extract.

High percentages of ether extract were recorded for blend (1) & (7), which contain corn, since corn contain high content of ether extract.

Table 3. Chemical composition of the weaning food blends (on dry weight basis per 100 g).

Blend	Moisture	Protein	Ether extract	Ash	Carbo-hydrates*	Crude fiber	Caloric Value**
1	6.5	50.8	2.3	2.8	72.8	1.3	395.1
2	6.8	22.0	1.9	2.9	71.9	1.3	392.7
3	6.2	17.3	2.0	2.0	77.2	1.4	396.0
4	7.3	17.1	2.1	2.1	76.7	1.9	394.1
5	6.2	20.720.	1.6	1.6	73.5	1.4	391.2
6	7.1	6	1.3	1.3	73.6	1.8	388.5
7	6.9	21.3	2.3	2.3	73.4	1.4	395.5
8	7.2	21.5	1.9	1.9	72.5	1.3	393.1
9	7.4	20.2	2.0	2.0	73.8	1.4	394.0
10	7.2	20.1	1.4	1.4	74.2	1.8	389.8
11	6.8	17.3	1.6	1.6	77.5	1.3	393.6
12	6.4	17.2	1.3	1.3	77.8	1.4	391.7

* Calculated by difference.
** Kcal per 100 g.

The results in table 4 show that ash content in weaning blends ranged from 2.1% to 2.9%. The highest percentage was recorded for blend (2), which contain defatted soy bean as a high source of ash and the lowest percentage was noticed for blend (3), which contain rice and sorghum, which are low in ash. Caloric value in weaning blends ranged from 388.5 (Kcal per 100g) to 396.0 (Kcal per 100g). The highest caloric value was notced for blend (3), since it contan wheat, corn and chickpeas, and the lowest caloric value was recorded for blend (6) which contained soy bean and mung bean.

These results are in agreement with Thompkison and Mathur (1985) who found that protein (14.5-22.0%), fat, (6.5-24.2%) carbohydrates, (50.0-72.9%) ash (3.5-6.8%), moisture (3.0-3.5%) and calories (408-495 Kcal/100g) of few infant formula marketed in India. Close results were recorded by Sidky (1995).

Minerals content of the weanng blends:

Results in table 4, show that most of the blends have nearly the same content of minerals, where as calcium in blend (8) was the highest (189.7 mg/100g). This is due to the presence of defatted soy bean and chickpeas which are high in calcium. The lowest content was (146.6 mg/100gm) in blend (4), since it contains rice and barley which are low in calcium. Iron contents ranged from 8.6 to 15.5 (mg/100 g). The highest content was recorded for blend (2) which contain defatted soy bean which is high in iron.

Table 4. Menirals content of weaning food blends (Per 100 g dry weight.)

Blends No.	Ca mg	K mg	Na mg	Mg mg	Mn Mg	Zn mg	Fe mg	Se ug
1	164.0	755.3	81.9	127.6	0.7	2.7	14.8	17.4
2	172.3	547.8	77.8	99.3	0.9	2.6	15.5	32.3
3	151.1	606.8	93.4	128.0	0.8	2.1	12.6	13.9
4	146.3	461.3	87.8	84.7	1.0	2.1	11.7	37.2
5	163.4	648.4	79.9	81.5	0.6	2.9	12.0	35.1
6	159.7	609.8	79.5	75.3	1.0	2.7	10.3	40.7
7	169.2	760.4	75.4	119.3	0.7	2.8	11.1	11.7
8	189.7	499.5	75.4	89.2	0.8	2.4	11.6	26.6
9	168.2	479.2	73.4	64.2	0.9	2.7	12.2	29.6
10	164.7	458.6	69.8	87.0	0.9	2.6	10.7	35.0
11	156.2	502.2	88.5	99.7	0.5	1.9	8.6	28.8
12	150.3	499.9	91.1	72.9	0.6	2.2	9.1	31.8

The lowest content of iron was noticed for blend (11) whch contained mung bean and wheat. Selenium contents ranged between 17.4 and 40.7 (ug/100g). The highest content was noticed for blend (6) which contain barley, mung bean and defatted soy bean (high in selenium) and wheat, the lowest contents was recorded for blend (1) which contained corn and wheat which are low in selenium. These results are in agreement with those of Esteve et al., (1994).

Weaning cookies were analyzed for moisture, protein, ether extract, ash, carbohydrates, crude fiber, and caloric value, Results are presented in table 5. The results show that the 12 samples of cookies were nearly similar for caloric value as well as the other consttuents with slight differences.

Moisture content in weaning cookies ranged from 8.3% to 9.4%. The highest percentage of moisture was recorded for cookies no. 9, and the lowest percentage of moisture was noticed for cookies (No.3). Protein content in weaning cookies ranged from 15.1% to 18.0%. The lowest percentage of protein was noticed for cookies(12), it contained chickpeas and mung bean, and the highest percentage of protein was recorded for cookies (2), which contaned soy bean and mung bean (contain high content of protein). Ether extract content in weaning cookies ranged from 14.9% to 16.5%. The highest percentage of ether extract was recorded for cookies (5).

Table 5. Chemical composition of the weaning cookie formulas (on dry weight basis per 100 gm)

cookie formulas	Moisture	Protein	Ether extract	Ash	Carbo-hydrates*	Crude fiber	Caloric Value**
1	8.4	16.4	15.8	1.7	65.2	0.9	768.6
2	8.8	18.0	15.6	1.8	63.7	0.9	467.2
3	8.3	15.3	14.9	1.4	67.4	1.0	464.9
4	9.3	15.1	15.0	1.4	67.3	1.2	464.9
5	8.5	16.4	16.5	1.7	64.2	0.8	470.9
6	9.0	16.3	15.3	1.6	65.7	1.1	465.7
7	8.7	16.1	16.1	1.6	64.2	1.0	470.1
8	9.1	17.7	15.5	1.8	64.1	0.9	466.7
9	9.4	16.0	15.0	1.6	66.4	1.0	464.6
10	9.1	15.9	15.6	1.5	65.8	1.2	467.2
11	8.6	15.2	16.0	1.4	66.6	0.8	471.2
12	9.0	15.1	15.1	1.4	67.5	0.9	465.4

* Calculated by difference.

** Kcal per 100 gm.

The lowest content of ether extract was noticed for cookies (3). Ash content ranged from 1.4% to 1.8%. Carbohydrates content in weaning cookies ranged from 63.7% to 67.5%. Crude fiber content of weaning cookies was between 0.8% and 1.2%.

Caloric value in weaning cookies ranged from 464.6 to 471.2 (Kcal per 100g).

These results are in agreement with El-Mahdy (1980) who indicated that protein, fat, carbohydrates and caloric values of infant food (sweet hard biscuits) were 13.9-17.9, 27.8-32.8%, 50.9-56.6% and 430 Kcal/100g respectively.

Close results were recorded by Bowes & Church (1983) who found that moisture, protein, fat, carbohydrates, crude fiber and calories of baby cookies were 5.7, 11.43, 12.86%, 62.86%, 1.43% and 400 Kcal/100 g respectvely.

Table 6. Minerals content of the weaning cookies (per 100 gm dry weight).

cookie formula	Ca mg	K mg	Na mg	Mg mg	Mn mg	Zn mg	Fe mg	Se µg
1	100.4	437.8	42.6	125.8	0.9	1.5	8.4	18.2
2	104.5	334.0	40.4	40.4	111.7	1.0	8.8	25.6
3	93.9	363.5	48.24	126.0	0.9	1.1	7.3	16.52
4	91.6	290.6	5.4	104.3	1.0	1.1	6.9	8.1
5	100.0	384.3	41.4	102.7	0.8	1.6	7.0	27.1
6	98.1	364.9	39.6	99.6	1.0	1.5	6.3	29.8
7	102.9	440.3	39.2	121.6	0.8	1.5	6.6	15.3
8	113.1	309.8	36.73	106.6	0.9	1.3	6.8	22.8
9	102.4	308.5	8.2	94.1	1.0	1.5	7.2	24.3
10	100.7	289.3	36.4	95.5	1.0	1.4	6.4	27.0
11	97.9	311.2	45.7	111.8	0.8	1.1	5.3	23.9
12	93.4	310.1	74.1	98.4	0.8	1.2	5.6	25.4

Tannin content of sorghum and barley.

The values of tanin content of soghum and Barley are shown in table 7. values were 0.46. CE/100g and 0.75g/100g. respectively.

After alkali treatment the tannin content decreased by 88.7% and 91.3%, respectively. After extrusion tannin was reduced by 13.5% and 16.9% for sorghum and barley, respectvely. Reducton of tannin were 90.2% and 92.77% for sorghum and barley respectively. It is known that tannin is one of the antnutritional factors in cereals.

These results are in ageement with Chavan *et al.,* (1979) who noticed that soaking of sorghum grains at 30°C in 0.05 M sodium hydroxide and potassium hydroxide removed 75-85% of the tannins in 24 hr. Treatment at 100°C increased the rate of extraction and reduced the time requred to decrease 75-85% of tannin content from 24 hr. to 20 min.

These results were close to those obtained by Youssef *et al.,* (1990) they studed two vareties of sorghum grains. The frst was hgh in tannin (2.9% catechin equivalent (CE). The second was low n tannin (0.19% CE).

Table 7. Effect of alkali and extrusion treatments on tannin content of sorghum & barley catechin equivalent (C.E/100 g.)

Material	Raw	After alkali treatment	After Extrusion	% Reduction of tannin
Sorghum	0.46	0.052	0.042	90.2
Barley	0.75	0.065	0.054	92.77

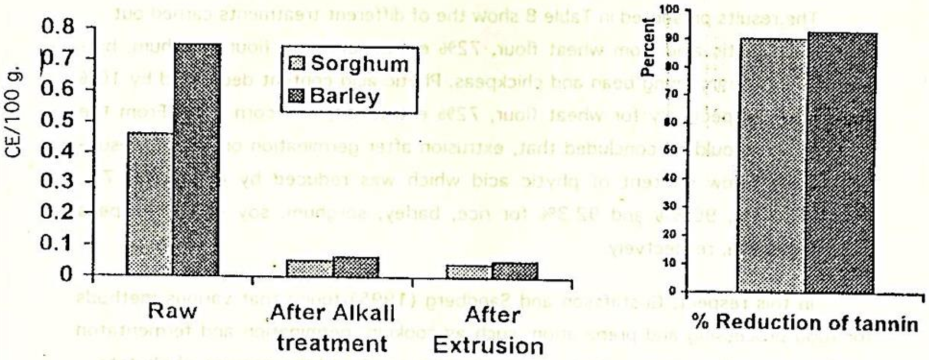

Fig.1. Effect of alkali and extrusion treatments on tannin content in sorghum & barley (CE/100 gm).

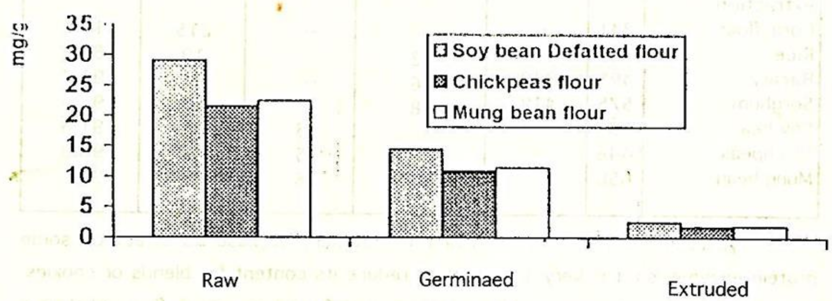

Fig.2. Effect of different treatments of the trypsin inhibitor content (mg/g)

The results presented in Table 8 show the of different treatments carried out to remove phytic acid from wheat flour, 72% extraction, corn flour, sorghum, barley, rice, soy bean, mung bean and chickpeas. Phytic acid content decreased by 10% and 10.8% respectively for wheat flour, 72% extraction, and corn flour. From the same table it could be concluded that, extrusion after germination or soaking resulted in a very low content of phytic acid which was reduced by 85.9%, 91.7%, 90.9%, 90.3%, 90.8% and 92.3% for rice, barley, sorghum, soy bean, chckpeas and munghbean, respectvely.

In this respect, Gustafsson and Sandberg (1995) found that various methods for food processing and preparation, such as cooking, germination and fermentaton which activate the intrinsic phytase in legume have reduced the content of phytate.

Table 8. Effect of different treatment on the phytic acid content (m/100 gm).

Samples	Raw	Treatments				
		Soaking in potsassium hydroxide	Soaking in deionzed water then in water	Germination	After extrusion	% Reduction of phytic acid
Wheat flour 72% extraction	250	--	--	--	225	10.0
Corn flour	241	--	--	--	215	10.8
Rice	135	--	22	--	19	85.9
Barley	495	340	46	--	41	91.7
Sorghum	575	419	58	--	52	91.6
Soy bean	670	--	--	73	65	91.6
Chichpeas	446	--	--	45	41	90.8
Mung bean	650	--	--	56	50	92.3

Trypsin inhibitor is very important to nutrtion, because its effect on some protein enzyme, so it is very important to reduce its content for blends or cookies. Table 9 show that trypsin inhibtor content in defatted soy bean flour, chckpeas flour, and mung bean flour were 29.1, 21.6 and 22.5 (mg/100 g) respectively, but after extrusion was carried out its content were reduced by 91.4%, 91.4%, 91.2% and 92.0% for defatted soy bean flour, chckpeas flour and mung bean flour respectively.

Table 9. Effect of different treatments of the trypsin inhibitor content (mg/g).

MaterialS	Raw	Germenated	Extruded
Soy bean Defatted flour	29.1	14.4	2.5
Chickpeas flour	21.6	10.9	1.8
Mung bean flour	22.5	11.5	1.9

Table 10 show that blends and cookies have a nearly the same content of results in table 10 trypsin inhibitor, it ranged from 1.08 to 1.26 mg/g in blends and from 1.04 to 1.11 mg/g in cookies. These results aftree with those obtained by Delvalle *et al.*, (1981) who indicated that powdered infant formula contained 11.3 TIU/mg, which was extremely low reflecting efficiency of heat treatment in the extruder.

Table 10. Trypsin inhibitor content of weaning blends cookies (mg/g).

Formula No.	Trypsin inhibtor content	
	Blends	Cookies*
1	1.23	1.10
2	1.20	1.10
3	1.17	1.05
4	1.081	1.04
5	1.21	1.11
6	1.18	1.09
7	1.26	1.13
8	1.20	1.10
9	1.20	1.10
10	1.17	1.08
11	1.11	1.05
12	1.11	1.05

* 50% of the formula + 50% wheat flour.

Table 11 show results in the fatty acids content of blends' lipid. The results showed that the esential F.A. linoleic and inolenic are present in all Blends Arachdonic acid which is one of EFA are only present in blend No. 7, 9, 10, 11, 12 which contained soy bean and mung bean.

Table 12 showed that the peroxide value of weaning blends the blend (10) recorded the highest peroxide value (12-10) ml eq/kg oil after six months of storage.

All blends indicated peroxide value under 20 ml. eq/Kg oil durng six months of storage.

Peroxide value of weaning cookies are shown in table 13, whereas the lowest peroxide value in cookies No. 3. The hghest peroxide value in cookers Nc. 10 in zero time. After six months of storage the lowest peroxide value was12.77 ml. eq/kg oil in cookies No. 3 and the hghest peroxide value was 18.2 mg. eq/Kg oil in cookies No. 10.

These results are in agreement with Dehiya & Kapoor (1994) who found that peroxide value of stored infant food were withen a specified range after 30 days.

Four weaning blends No. (1, 2,3 and 4) were investigated for water absorption index (WAI) water solubility index (WSI), water retenton % cold-paste viscosity, hot-paste viscosity and cooked-paste vscosity (Table 14). The data showed that the water absorbtion index was the highest in blend No. 4. The lowest showed that the water absorbtion index was the highest in blend No. 4. The lowest water absorption index was in blend No. 2. Water solubilty index was highest in blend No. 4 and the lowest WSI was in blend No. 3. Cold-paste viscosity and hot paste viscosty were the highest in blend No. 2. It contain extruded sorghum and extruded soy bean. The increase in cold-past vsocsity indicate that this blend (No. 2) is suitable to prepare without any heating. The ncrease in hot-paste viscosty due to the complete gelatinzation of starch. Cooked-paste viscosity was the hghest in blend No. 1 which contained wheat, corn, soy bean mung bean. Water retention was the hghest in blend No. 4 which contained rice, sorghum, Chickpoeas and mung bean. The lowest percentage of water retention was noticed in blend No. 3 which contains wheat, corn, chickpeass and mung bean.

From theses results it can be noticed that blends No. 2 is considered the best weaning food formula because it has high value of cold-paste viscosity and medium values of WAI (7.1), WSI (41.3) and water retention (590%).

Table 15. showed the organoleptic total scores of stored weaning blends. We noticed that there is no significance between any two storage perods of the most of the same blend in the first four months. The average score for over all the organoleptic were high n blend 1.8 and in zero time. After four months of storage blends 1.2 and 11 were still recording high scores.

Table 16. showed the average scores for over all of organoleptic properties of weaning cookies during the storage period. We noticed that the early months of storage showed no sgnificant difference between any two storage periods of the same blend.

The average overall score for of the oranganoleptic properties were high in cookies 11 and 12.

Table 16.

Dahiya & kappor (1994) reported that sensory properties of infant food supplements were not significantly affected by storage of one month and all suppleme-nts were judged acceptable for consumption.

Gahawat & Sehgal (1994) found that weaning foods (made with wheat, barly, green gram and jaggery). were judged acceptable for consumption after 60 days of storage.

REFERENCES

1. AACC (1983). Baking quality of self rising biscuit flour, American Assocaton of Cereal Chemists Vo., 1 Page 2 of 3.

2. AoAC (1970). " Official Methods of Analysis", Association of Offcial Analytical Chemsts, PO Box 450, Benjamin Frankin StationWashington, DC 2044.

3.AOAC (1990). Offical Mathods of Analysis (15 theed.). Assocation of Offcal Analytical Chemists, Washington Dc. USA.

4.Becker, R., Wheeler, E.L., Lorenz, K. Stafford A.E. Grosjean, O.K. Bsehart, A.A. ands Saunders R.M. (1981). A compositional study amaranth grain. J. Food Sci. 46, 1175-1180.

5. Bowes,A.D. and Church, C.f. (1983). Food values of protions commony used 14 th edition. J.B. Lippincott Company, Philladelpha Mexico City New York San Paulo St. Louis Sydey.

6. Bressani, R., Braham, J.E. Elias, L.G. and Molina, M.R. (1978). Protein quality of wholes corn/whple soy bean mixture processd by a simple extrusion cooker of Food Sci. 43:5. 1563-1565.

7. Burnsm R.E. (1971). Method for estimatof tannin in grain sorghum Agronomy journ, M. and hofander, Y. (1983).Manual on feeding infant and young Journal 63, 101-102.

8. Cameron, M. and Hofander, Y. (1983). Manual on feeding infant and yourg chidran, Oxford Unversity Press. Delhi-Nairobl .

9. Chavan, J.K. Kadam, S.S. Ghonsikar, C.P. and Salunkhe, D.K. (1979). Removal of tannins and improvement of n vitro protein digestibty of sorghum seeds by soaking in alking in alkali. J. Food Sci. 44, 1319-1321.

10.Colonna, P. Doubler, J.L. Melcion, J.P. Monredon, F. and mercier C. (1984). Extrusion cooking anddrum drying of Chimistry macromolecular modifications. Cereal Chmistry 61.6 : 538-543.

11. Dahiya, S. and Kapoor A.C. (1994). Development, nutritive content and shelf life of home processed supplementary foods. Plant Foods forHuman Nutriton. 45:4, 331-342.

12. Del-Valle, F.R., Vilanueva, H., Reyes-Govea, J. Escobedo, M. Bourges, H., Ponce J, and Mounoz, M.J. (1981) Development, evaluaton and industrial production of the powdered soy-oats infant formula using a low cost extruder. J. Food Sci., 46,192-197.

13.El-Mahdy, R.M. (1980). Technological studies on the production of baby food in Egypt. Ph. D. Thesis Faculty of Agriculture, Ain Shams university- Egypt.

14. Esteve, M.J., Farre, R. and Frigola, A. (1994). Determination of Cd, Cu, Pb and Zn content of infant formulas by differential stripping Voltammetry. Nahrung, 35,4,386-392.

15. Gahlawat, P. and Sehgal, S. (1994). Shelf lfe of weaning food developed from localy anailable food stuffs. Plant Food for Human Nutrition, 45:4 349-355.

16. Gustafsson, E.L. and Sandberg, A.S. (1995). Phyates reduction in brown bean (Phaseolus Vulgaris L.)J. Food Sci. . 60:. 1.149-156.

17. Kakade, M.L. Simons, N. and Liener, I. E. (1969). An evaluation of natural synthetic substrates for measuring the antitryptic activity of soy bean sample. J. cereal Chim. 519-526.

18. Kng, R. D. and Puwastien (1987). Effect of germination on the proximate composition and nutritional quality of winged bean seeds.

19. Liener, I.E. (1980). Toxic constituents of plant food stuffs. Academic Press New York, London Toronto SydneySan Francisco.

20. Lilianu, T. and Marai R.S. (1985). Effect of germination on phytic acid, protein and fat content of rapessed. J. Food Sci. 50, 1200.

21. Marero, L.M., Payumo, E.M., Librando, E.C., aomez, W.N. Gopez M.O. and Homma, S. (1988). Technology of weaning food formulatons prepared from germinated Cereals and egumes.

22. Mercier, C. and Feillet, P. (1975). Modifcation of carbohydrate components by extrution cookng of cereal products. Cereal Chemistry 52 (3) 285-297.

23. Mohamed, A. Perea, P.A.J.and Haffez, Y.S. (1986). New chromophore for phytic

الصفات الكيميائية والطبيعية لأغذية الفطام المحضرة من الحبوب والبقوليات

فريال عبد العزيز اسماعيل ١ فاطمة سيد جلال ١
يحى صابر العطوى ٢ عزه احمد بكرى حمزه ٢

١ كلية الزراعة – جامعة القاهرة – الجيزة.

٢ معهد بحوث تكنولوجيا الأغذية - مركز البحوث الزراعية – مصر.

تم إعداد اغذية الفطام (خلطات وبسكوتات) بإستخدام دقيق القمح استخلاص ٧٢٪ ودقيق الأرز ودقيق الشعير ودقيق الصويا المنزوع الدهن ودقيق الحمص ودقيق فاصوليا المنج . كما استخدام اللبن المجفف منزوع الدسم .

وتم ازالة بعض العوامل المضادة للتغذية من الخامات المستخدمة مثل ازالة حمض الفيتيك والتانينات ومضاد انزيم التربسين وذلك باجراء بعض المعاملات مثل النقع فى القلوى والنقع فى الماء المقطر والإنبات والبثق الحرارى وأظهرت نتائج التحليل الكيميائى لأغذية الفطام على احتوائها على بروتين بنسبة تتراوح ما بين ١٥,١ الى ٢٢٪ وبالنسبة للمستخلص الاثيرى نسبته ١,٣ –١٦,٥٪ والرماد نسبته ٢,٩–١,٤٪ والكربوهيدرات ٧٧,٨–٦٣,٧٪. والألياف ٠,٩–١,٩٪ . والأغذية المحضرة تحتوى على نسبة عالية من الأملاح المعدنية لعناصر فول الصويا وفاصوليا المنج تحتوى على الثلاث أحماض الدهنية الأساسية.وبالتخزين لمدة ٦ شهور فإن قيم البيروكسيد لم تزد عن الحد المسموح به .

أظهرت نتائج التقييم الطبيعى أن هذه الأغذية مناسبة للأطفال فى عمر الفطام وأثبتت نتائج التقييم الحس على صلاحية أغذية الفطام المحضرة خلال فترة تخزين بلغت ستة أشهر.