RESULTS
AND
DISCUSSION

4. RESULTS AND DISCUSSION

4.1. Chemical composition of the raw materials:

The materials used in this investigation were fruits (guava, apricot, orange, lime and dry dates); vegetables (carrot and garden-rocket); oil seeds (sesame and peanut); Legumes (Fenugreek, lentil and lupine); and dry yeast. The raw materials were chemically analyzed for there moisture, pH value, total acidity, reducing sugars, total sugars, total free phenolic compounds, total free amino acids, crude protein, crude fiber, ash, fat, total carbohydrates and minerals. Results are shown in Table (1).

Results appear that peanut and sesame had the lowest percentage of moisture content being 5.89 and 5.32%, respectively. The dry yeast, fenugreek, lentil, lupine and dry dates had moisture content ranged from 6.17 to 13.19%. Guava, apricot, orange, carrots, lime and garden-rocket had high moisture content which were 80.85, 83.79, 87.25, 88.35, 89.14 and 89.67%, respectively. These results agree with **Kirk and Sawyer (1991)** and **Mohamed (2000)** for peanut and sesame, **Bahlol (1993) and Abo-Zaid (1984)** for dry yeast, fenugreek, lentil and lupine and **Ragab (1987)**, **El-Atway *et al.* (1994), Ramadan (1995) and Rezk (2003)** for guava, apricot, orange,carrots, lime and garden-rocket.

Lime had the lowest pH value (2.13), but dry yeast had the highest pH value (6.5), meanwhile, the other foods had

Table (1): Chemical composition of the raw materials used for the preparation of formulated food mixtures (g/100g) (Mean ± S.E.).

Chemical Comp. / Raw materials	Moisture (%)	pH value	Total acidity* (%)	Reducing sugars* (%)	Total sugars* (%)	Total free phenolic compounds* (%)	Total free amino acid* (%)	Crude protein* (%)	Crude fibre* (%)	Ash* (%)	Fat* (%)	Total carbohy-drate* (%)
Guava	80.85 ±0.01	4.20	3.11 ±0.001	13.78 ±0.03	38.59 ±0.04	1.61 ±0.01	1.25 ±0.02	5.15 ±0.015	10.09 ±0.01	3.17 ±0.01	1.98 ±0.01	89.70 ±0.02
Apricot	83.79 ±0.01	3.50	12.89 ±0.02	19.68 ±0.02	39.79 ±0.03	1.83 ±0.003	0.83 ±0.01	4.74 ±0.02	4.06 ±0.01	4.05 ±0.01	3.58 ±0.01	87.63 ±0.02
Dry date	13.19 ±0.01	5.96	0.24 ±0.001	42.44 ±0.02	67.69 ±0.02	1.61 ±0.06	1.97 ±0.01	2.78 ±0.01	2.91 ±0.01	2.49 ±0.01	0.67 ±0.01	94.06 ±0.01
Orange	87.25 ±0.01	3.75	6.97 ±0.02	38.12 ±0.01	63.19 ±0.03	2.63 ±0.01	2.65 ±0.040	6.71 ±0.01	6.22 ±0.01	3.32 ±0.02	2.10 ±0.01	87.87 ±0.01
Lime	89.14 ±0.02	2.13	39.05 ±0.01	6.87 ±0.03	18.19 ±0.03	2.93 ±0.01	3.03 ±0.01	6.89 ±0.002	5.76 ±0.02	3.79 ±0.02	4.51 ±0.03	84.81 ±0.01
Carrot	88.35 ±0.02	60.0	0.77 ±0.001	30.47 ±0.01	51.54 ±0.03	2.85 ±0.01	3.64 ±0.02	9.14 ±0.02	7.87 ±0.03	6.01 ±0.02	2.06 ±0.01	82.79 ±0.01
Garden-rocket	89.67 ±0.01	5.15	2.99 ±0.01	1.65 ±0.02	16.37 ±0.03	1.24 ±0.03	3.80 ±0.001	24.44 ±0.02	10.07 ±0.02	16.19 ±0.01	4.92 ±0.02	54.45 ±0.01
Peanut	5.89 ±0.002	6.40	0.34 ±0.002	0.98 ±0.003	3.60 ±0.02	0.35 ±0.001	0.49 ±0.001	26.39 ±0.02	3.67 ±0.003	2.60 ±0.02	47.71 ±0.01	23.30 ±0.01
Sesame	5.32 ±0.01	5.80	0.32 ±0.001	1.43 ±0.03	4.05 ±0.01	0.15 ±0.001	0.12 ±0.002	22.05 ±0.03	4.45 ±0.01	4.19 ±0.03	52.39 ±0.01	21.37 ±0.02
Lupine	8.85 ±0.01	5.40	0.54 ±0.002	0.36 ±0.002	1.92 ±0.01	0.17 ±0.002	0.19 ±0.002	42.06 ±0.03	5.41 ±0.01	3.57 ±0.01	12.73 ±0.02	41.64 ±0.02
Lentil	8.69 ±0.02	6.20	0.45 ±0.001	0.90 ±0.002	1.39 ±0.02	0.09 ±0.001	0.66 ±0.00	25.13 ±0.03	2.11 ±0.01	2.60 ±0.01	1.41 ±0.02	70.86 ±0.02
Fenugreek	8.33 ±0.01	6.30	0.44 ±0.002	1.67 ±0.012	4.87 ±0.01	0.19 ±0.001	1.33 ±0.022	29.99 ±0.01	9.93 ±0.01	3.64 ±0.02	5.11 ±0.03	61.26 ±0.02
Dry yeast	6.17 ±0.01	6.50	0.32 ±0.002	0.97 ±0.001	1.57 ±0.02	0.38 ±0.003	0.28 ±0.002	31.22 ±0.01	4.15 ±0.02	8.38 ±0.003	2.09 ±0.02	58.31 ±0.03

Total acidity was measured as citric acid
Total free amino acid was measured as glycine.

Total free phenolic compounds was measured as caticol.
*** On dry weight.**

pH values ranged from 3.5 to 6.4, as reported by **Hamouda (2001) and Rezk (2003).**

Dry dates had the lowest content of total acidity (0.24%), while lime had the highest content of total acidity (39.05%) followed by apricot (12.89%), orange (6.97%), the other materials had total acidity ranged from 0.32 to 3.11%.These results agree with **Nezam-El-Din (1978), El-Deeb (1990), Ramadan (1995) and Hamouda (2001).**

Lupine had the lowest reducing sugars (0.36%), while dry dates had the highest content of reducing sugars (42.44%), followed by orange (38.12%), carrots (30.47%), the reducing sugars of apricot and guava were 19.68 and 13.78%, respectively, while reducing sugars in other materials were ranged from 0.90 to 6.87%, as reported by **Grobler *et al.* (1984), Grass *et al.* (1988), Ramadan (1995) and Aly (2001).**

Lentil had the lowest content of total sugars (1.39%). Dry yeast , lupine, peanut, sesame, fenugreek, garden-rocket and lime contained 1.57, 1.92, 3.60, 4.05, 4.87, 16.37 and 18.19% total sugars, respectively, while dry dates had the highest value of total sugars (67.69%) followed by orange (63.19%), carrots (51.54%), apricot (39.79%), guava (38.59%). These results are in accordance with those reported by **Nezam-El-Din (1978), Ragab (1987), Ibrahim (1990), Hamoda (2001) and Abo-Zaid (2002).**

Lentil had the lowest content of total free phenolic compounds (0.09%). Meanwhile, lime had the highest content of total free phenolic compounds (2.93%) followed by carrots

(2.85%) and orange (2.63%), and the free phenolic compounds content of other materials ranged from 0.15 to 1.83%. Sesame and lupine had the lowest total free amino acid contents (0.12 and 0.19%), respectively. Garden-rocket had the highest content of total free amino acid (3.80%), while carrot and lime contained 3.64 and 3.03%, respectively, as shown in Table (1).

The lowest content of crude protein was observed for dry dates(2.78%) as reported by **Ramadan (1995)and Abo-Zaid (2002).** Apricot, guava, orange, lime and carrot contained 4.74, 5.15, 6.71, 6.89 and 9.14%, respectively, as found by **Abdel-Latife, Bothyna (1990) and Aly (2001).** Meanwhile, the maximum crude protein was found in lupine (42.06%) and dry yeast (31.22%). Also, high crude protein content were 22.05, 24.44, 25.13, 26.39 and 29.99% in sesame, garden-rocket, lentil, peanut and fenugreek, respectively. These results agree with those obtained by **Bahlol (1993) and Abdel-Aal (2002).**

Lentil and dry date contained the lowest level of crude fiber (2.11 and 2.91%), respectively, as reported by **Aly (2001).** But the highest levels of the crude fiber were found in garden-rocket and guava (10.07 and 10.09%), respectively (**Abdel-Aal, 2002),** which followed by fenugreek (9.93%) and carrot (7.87%). The crude fiber content in other materials were ranged from 4.06 to 5.76%, as found by **Abd El-Ghani (1992) and Bahlol (1993).**

From the results it could be showed that lentil, peanut and dry dates had the lowest levels of ash as follows: 2.60, 2.60 and 2.49%, respectively, as found by **Bahlol (1993) and Ramadan (1995),** but garden-rocket had the highest level of ash

(16.19%), as reported by **Ismail, Ghada (2002).** Meanwhile, the ash of guava, fenugreek, lupine, apricot, orange, lime, carrot, sesame and dry yeast ranged from 3.17 to 8.38%, as shown in Table (1).These results agree with those reported by **Bahlol (1993), Sanad (1991), Aly (2001), Hamouda (2001) and Rezk (2003).**

The lowest fat levels were observed in dry dates (0.67%) followed by lentil (1.41%) and guava (1.98%), as reported by **Bahlol (1993) and Hasanien, Manal (1994).** While, the highest levels were found in sesame (52.39%) and peanut (47.71%). Also, the fat in carrot, fenugreek, apricot, orange, lime, garden-rocket, dry yeast and lupine ranged from 2.06 to 12.73% , as found by **Nour and Magboul (1986), Kirk and Sawyer (1991), Aly (2001), Hamouda (2001), Ismail, Ghada (2002) and Abo-Zaid (2002).**

On the other hand, from the results it could be noted that total carbohydrate was low in sesame and peanut which were 21.37 and 23.30%, respectively. However, dry dates and guava had the highest total carbohydrates (94.06 and 89.70%), respectively. Also, orange, apricot, lime and carrot had high content of total carbohydrate which were 87.87, 87.63, 84.81 and 82.79%, respectively. Total carbohydrate in lupine, fenugreek, garden-rocket, dry yeast and lentil, ranged from 41.64 to 70.86%, as shown in Table (1). These results agree with those reporated by **El-Shamery (1988), Bahlol (1993), Hasanien, Manal (1994), El-Nagar (1997), Aly (2001) and Abo-Zaid (2002).**

4.2. Minerals content of the raw materials:

The ash of raw materials contains some important minerals to various human body structure and functions. Table (2) appears the minerals contents of different raw materials used in this investigation.The surveyed minerals were potassium, phosphorus, calcium, magnesium, iron and sodium, beside some trace elements (zinc, manganese and copper).

The obtained data revealed that the maximum level of potassium was observed in carrot (2685.80 mg/100 g), dry yeast (2036.20 mg/100 g) and garden-rocket (2005.60 mg/100 g) as reported by **Luh and Woodroof (1988), El-Gendy (1987), Ismail, Ghada (2002) and Abo-Zaid (2002).**Also, apricot, lentil, lime and guava had high potassium content which were 1037.60, 963.70, 837.80 and 804.18 mg/100 g, respectively, while potassium of sesame, dry dates, peanut, fenugreek, orange and lupine ranged from 321.70 to 733.99 mg/100 g. These results agree with those reported by **Habiba (1982), Sanad (1991), Hasanien, Manal (1994), Hamouda (2001) and Rezk (2003).**

Sesame and lupine had the highest levels content of phosphorus (619.88 and 558.41 mg/100 g), respectively. Orange, fenugreek, peanut, lentil, garden-rocket, carrot, lime, apricot and dry yeast had also high phosphorus content which ranged from 125.41 to 465.50 mg/100 g. The lowest levels was found in dry date (61.80 mg/100 g) and guava (99.16 mg/100 g) as reported by **Abd-El-Aal and Rahama (1986), Aly (2001), Hamouda (2001) and Abo-Zaid (2002)**

Table (2): Mineral content of the raw materials (mg/100g) (on dry weight basis) (Mean ± S.E.)

Raw materials	K	P	Ca	Mg	Fe	Na	Zn	Mn	Cu
Guava	804.18 ±0.04	99.16 ±0.01	88.72 ±0.05	31.12 ±0.04	3.49 ±0.02	47.15 ±0.04	0.69 ±0.02	0.60 ±0.003	1.42 ±0.03
Apricot	1037.60 ±0.21	154.20 ±0.11	110.98 ±0.03	3.33 ±0.03	5.03 ±0.01	116.30 ±0.14	0.35 ±0.003	0.49 ±0.001	0.83 ±0.02
Dry date	625.19 ±0.03	61.80 ±0.15	65.30 ±0.02	65.59 ±0.02	4.69 ±0.01	15.16 ±0.02	0.68 ±0.003	1.32 ±0.02	0.99 ±0.003
Orange	493.30 ±0.25	125.41 ±0.01	266.70 ±0.115	50.04 ±0.02	3.91 ±0.02	20.31 ±0.02	5.30 ±0.11	0.38 ±0.002	0.69 ±0.001
Lime	837.8 ±0.09	159.21 ±0.01	293.60 ±0.11	50.46 ±0.02	4.22 ±0.01	20.99 ±0.003	0.83 ±0.002	0.36 ±0.002	0.63 ±0.002
Carrot	2685.80 ±0.32	180.20 ±0.18	286.80 ±0.15	163.50 ±0.18	8.14 ±0.03	334.80 ±0.17	5.41 ±0.01	1.83 ±0.01	2.10 ±0.02
Garden-rocket	2005.60 ±0.11	280.70 ±0.18	1281.20 ±0.15	115.97 ±0.003	67.80 ±0.06	243.60 ±0.15	3.79 ±0.01	3.41 ±0.01	2.39 ±0.03
Peanut	552.90 ±0.12	344.62 ±0.02	149.79 ±0.02	114.86 ±0.01	2.54 ±0.02	8.40 ±0.15	3.39 ±0.02	1.03 ±0.01	0.76 ±0.004
Sesame	321.70 ±0.27	619.88 ±0.01	104.40 ±0.18	5.92 ±0.03	1.62 ±0.01	5.88 ±0.01	6.53 ±0.03	1.77 ±0.01	1.98 ±0.01
Lupine	733.99 ±0.02	558.41 ±0.02	94.33 ±0.02	130.83 ±0.02	4.78 ±0.02	66.79 ±0.03	5.51 ±0.02	1.41 ±0.01	0.87 ±0.002
Lentil	963.70 ±0.12	344.50 ±0.15	62.45 ±0.02	76.76 ±0.02	6.31 ±0.02	3.02 ±0.01	3.70 ±0.01	2.07 ±0.03	0.95 ±0.002
Fenugreek	539.90 ±0.03	399.90 ±0.03	180.70 ±0.12	151.96 ±0.02	26.68 ±0.02	62.24 ±0.01	3.51 ±0.01	1.36 ±0.03	0.44 ±0.003
Dry yeast	2036.20 ±0.09	465.50 ±0.17	47.30 ±0.21	74.98 ±0.01	13.39 ±0.001	13.08 ±0.02	10.64 ±0.01	0.79 ±0.003	0.78 ±0.001

The highest content of calcium in garden-rocket (1281.20 mg/100 g) (as found by **Ismail, Ghada (2002)),** followed by lime (293.60 mg/100 g), carrot (286.80 mg/100 g), orange (266.70 mg/100 g) and fenugreek (180.70 mg/100 g). Meanwhile, the calcium of dry yeast, apricot, lupine, guava, dry dates, lentil, peanut and sesame ranged from 47.30 to 104.40 mg/100 g. These results are comfirmed by those reported by **Abd-El-Aal and Rahama (1986), Habiba (1982), Sanad (1991), El-Sayed, Sahar (2000) and Hamouda (2001).**

Carrot, fenugreek and lupine had the highest content of magnesium (163.50, 151.96 and 130.83 mg/100 g), respectively, as reported by **Nour and Magboul (1986), El-Gindy (1987) and Todorov *et al.* (1996),** but sesame and apricot had the lowest content of magnesium 5.92 and 3.33 mg/100 g, respectively, as found by **Habiba (1982),Sanad (1991), Hamouda (2001) and Abo-Zaid (2002).** Meanwhile, magnesium content in guava, peanut, lentil, dry yeast, dry date, lime, orange and garden-rocket ranged from 31.12 to 115.97 mg/100 g,

Also, from the results (Table, 2) it could be observed that garden-rocket had the highest content of iron (67.80 mg/100 g) followed by fenugreek (26.68 mg/100 g), while the iron of sesame, carrot, lentil, apricot, lupine, dry dates, lime, orange, guava, peanut and dry yeast were ranged from 1.62 to 13.39 mg/100 g. These results are agree with those reported by **Sood *et al.* (1982), El-Sayed, Sahar (2000), Hamouda (2001) and Abo-Zaid (2002).**

Carrot and garden-rocket had the highest content of sodium (334.80 and 243.60 mg/100 g), respectively, but lentil had the lowest content of sodium (3.02 mg/100 g). However, in sesame, fenugreek, dry dates, lupine, guava, orange, lime, dry date and apricot ranged from 5.88 to 116.30 mg/100 g [**Sanad (1991), Hasanine, Manal (1994), El-Sayed, Sahar (2000) and Hamouda (2001)].**

Dry yeast contained the highest level of zinc (10.64 mg/100 g) which followed by sesame (6.53 mg/100 g), but in peanut, lentil, fenugreek, carrot, garden-rocket, orange and lupine ranged from 3.39 to 5.51 mg/100 g. **[Luh and Woodroof (1988), Todorv *et al.* (1996), Mohamed (2000) and Abd-El-Aal (2002)].** However, the lowest content of zinc was found in apricot (0.35 mg/100 g), dry date (0.68 mg/100 g), guava (0.69 mg/100 g) and lime (0.83 mg/100 g) as reported by **Hamouda (2001), Ismail, Ghada (2002) and Rezk (2003).**

Garden-rocket contained the maximum concentration of manganese (3.41 mg/100 g) followed by lentil (2.07 mg/100 g). Lime, orange, apricot, guava and dry yeast had the lowest content of manganese (0.36, 0.38, 0.49, 0.60 and 0.79 mg/100 g), respectively, as found by **Hasanien, Manal (1994), Aly (2001), Hussein (1983), Ismail, Ghada (2002) and Rezk (2003).**

Garden-rocket had the highest level content of copper (2.39 mg/100 g) followed by carrot (2.10 mg/100 g), but fenugreek had the lowest content of copper (0.44 mg/100 g) **[Luh and Woodroof (1988), Aly (2001) and Hamouda (2001)]**, while the content of copper in other materials was ranged from 0.63 to 1.98 mg/100 g, When compared the results in Table (2) with the Recommended daily requirements by **NRC(1980) and WHO (1985),** it could be observed that most of the raw materials contain high percentage of the minerals which the body needs.

*** It may be concluded that :**

- **Guava** is rich in total carbohydrate, crude fibre, some vitamins (vit. C and A) and copper .
- **Apricot** is rich on total carbohydrate, vit. C, β - carotene, potassium and iron.
- **Dry date** is rich in total carbohydrate, total sugars, reducing sugars, iron and some vitamins (vit. B_6, B_{12} and folic acid).
- **Orange** is rich in total carbohydrate, total sugars, reducing sugars, total free phenolic compounds, calcium, zinc and some vitamins (vit.C and folic acid).
- **Lime** is rich in total carbohydrate, total free phenolic compounds, phosphorus, calcium, vitamin C and β-carotene.
- **Carrot** is rich in total carbohydrates, total sugars, reducing sugars, total free phenolic compounds, total free amino acid, some minerals (potassium, phosphorus, calcium, mgnesium, iron, zinc and copper) and some vitamins (vit. A, B_6 and B_{12})
- **Carden- rocket** is rich in total free amino acid, crude fibre, ash, some minerals (potassium, phosphorus, calcium, iron, sodium and copper) and vitamin A.

- **Peanut** is rich in crude protein, fat, phosphorus and some vitamins (vit. B_6, B_{12} and folic acid).
- **Sesame** is rich in crude protein, fat, some minerals (phosphorus, zinc and copper) .
- **Lupine** is rich in crude protein and some minerals (phosphorus, iron and zinc)
- **Lentil** is rich in crude protein, total carbohydrate, some minerals (potassium, phosphorus, some vitamins (vit. B_1, B_2, B_6, B_{12} and folic acid) and β- carotene.
- **Fenugreek** is rich in crude protein, crude fibre, some minerals (phosphorus and iron) and some vitamins (vit. B_2, B_6, B_{12} and folic acid)
- **Dry yeast** is rich in crude protein, ash, potassium, phosphorus, iron, zinc and vitamins B complex.

4.3.Chemical composition of the formulated food mixtures:

The formulated food mixtures which were divided into 6 types were chemically analyzed in order to determine main chemical composition as following:

4.3.1. Type No. 1 (Food mixture No. 1/1):

Formulated food mixture as source to compensate the deficiency of vitamins B_1, B_2, B_6, B_{12} and folic acid, was composed from:

49.5 % lentil + 49.5% defatted peanut + 1% dry yeast (Table IV, mixture 1/1).

4.3.1.1.Chemical composition of formulated food mixture of type No.1/1:

The chemical composition of food mixture N0. 1/1 was determined and the data which were obtained are recorded in Table (3). It could be noted that the moisture content was low at zero time and was observed a slight change during storage.

The pH value was 6.51 at zero time and minor changes was observed during storage, also the total acidity was 0.61% and did not show any changes by storage.

The reducing and total sugars were decreased gradually by storage, these decreases may be attributed to the non enzymatic browning, as reported by **Nezam El-Din (1978) and Ragab (1987).**

Total free phenolic compounds were decreased from 0.23 to 0.22%, this decrease is very low and may be related to the effect of storage on the changes of free phenolic amino acids (tyrosine, phenylalanine) to insoluble phenolic compounds through the maillard reaction to form melanodine pigments **(Meyer, 1978),** also the total free amino acids showed a clear decrease by storage (from 0.58 to 0.51%), this change could be related to the non-enzymatic browning reaction. These results are in agreement with the results given by **Afifi (1995).**

The crude protein was ranged from 25.87 to 25.85% by storage, the high percentage of protein may be related to the high protein content of lentil and peanut (Table, 1), and as found by **Bahlol (1993).** Also, very low changes was observed for crude

Table (3): Chemical composition of formulated food mixture No.1/1 (Mean ± S.E.)

Chemical composition	Mixture No. 1/1			
	Storage periods (months)			
	Zero	3	6	9
Moisture (%)	6.82± 0.01	6.82± 0.003	6.83± 0.01	6.83± 0.01
pH value	6.51	6.50	6.50	6.50
Total acidity* (%)	0.61± 0.004	0.61± 0.001	0.61± 0.002	0.61± 0.002
Reducing sugars* (%)	1.02± 0.002	1.01± 0.004	0.98± 0.003	0.97± 0.003
Total sugars* (%)	2.35± 0.003	2.34± 0.003	2.34± 0.004	2.33± 0.002
Total free phenolic compounds * (%)	0.23± 0.003	0.22± 0.002	0.22± 0.003	0.22± 0.004
Total free amino acids* (%)	0.58± 0.002	0.57± 0.001	0.56± 0.002	0.51± 0.003
Crude protein* (%)	25.87± 0.02	25.86± 0.01	25.86± 0.02	25.85± 0.02
Crude fiber* (%)	2.82± 0.02	2.82± 0.02	2.82± 0.02	2.81± 0.02
Ash* (%)	2.57± 0.01	2.56± 0.02	2.56± 0.01	2.55± 0.01
Fat* (%)	3.44± 0.002	3.44± 0.003	3.44± 0.02	3.44± 0.03
Total carbohydrate* (%)	68.12± 0.02	68.14± 0.02	68.14± 0.02	68.16± 0.01
Total carotenoids (as B-carotene) (mg/100g)	9.98 ± 0.01	9.72 ± 0.01	9.45 ± 0.01	9.29 ± 0.02

*** On dry weight.**

fiber and ash during storage for food mixture No. 1/1 (from 2.82 to 2.81 and 2.57 to 2.55%), respectively, as found by **Hasanien, Manal (1994) and Mohamed (2000).**

The fat content of food mixture No. 1/1 was 3.44% which did not change by storage. The total carbohydrate was ranged from 68.12 to 68.16% as found in Table (3).

Total carotenoids of the food mixture No. 1/1 was 9.98 mg/100 g, which decreased by storage for 9 months to 9.29 mg/100 g. This decrease can be attributed to the degradation of carotenoids, these results coincide with those reported by **Mostafa (2002).**

4.3.1.2. Vitamins content of the formulated food mixture No. 1/1

With regard to vitamins content of the formulated food mixture No. 1/1, it could be noted from Table (4) that the vitamins B_1, B_2, B_6, B_{12} and folic acid contents were 5.79, 1.51, 1.53, 6.75 mg/100 g and 132.7 μg/100g, respectively, which decreased by storage to 5.51, 1.44, 1.22, 6.52 mg/100 g and 115.7 μg/100 g, respectively. This decrease may be related to the effect of light or oxidation on these vitamins. Also, it could be observed from the data that there was high content of vitamins B_1, B_2, B_6, B_{12} and folic acid in food mixture No. 1/1 when compared to the daily requirements of adults **(Recommended Dietary Allowances (RDA), 1989).** So, this food mixture is very suitable for treating of the deficiency of vitamins B_1, B_2, B_6, B_{12} and mean part of folic acid.

Table (4): Total vitamins content of formulated food mixture No.1/1 (on dry weight basis).

Vitamins content	Mixture No. 1/1		Recommended daily requirement	(%)
	Storage periods (months)		Adults	
	Zero	9		
B_1 (mg/100)	5.79	5.51	1.1-1.5	526.4
B_2 (mg/100)	1.51	1.44	1.3-1.8	116.1
B_6 (mg/100)	1.53	1.22	1.4-2	109.3
B_{12} (mg/100)	6.75	6.52	2	337.5
Folic acid (μg/100g)	132.7	115.7	150-200	88.5

4.3.1.3. Minerals content of the formulated food mixture No.1/1

Minerals content, of formulated food mixture No. 1/1 included major and trace elements, were determined and the data are shown in Table (5). From the data it could be shown that, one handered grams of the mixture No. 1/1 offered 47.85 of daily requirements of potassium, 30.83 of phosphorus, 9.11 of calcium, 17.71 of magnesium, 42.67 of iron, 32.92 of zinc and 52.35% of copper, and low levels of sodium and manganese which were 0.37 and 0.44%, respectively, when compared to the daily requirements of adults **(NRC, 1980 and RDA, 1989).**

Table (5): Minerals content of formulated food mixture No.1/1 (on dry weight basis) (Mean ± S.E.).

Minerals	Mixture No. 1/1 (mg/100g)	Recommended daily requirement (mg)	(%)
		Adults	
Potassium	789.50 ±0.03	1650-1875	47.85
Phosphorus	364.56 ±0.02	1200	30.38
Calcium	109.35 ±0.04	1200	9.11
Magnesium	47.81 ±0.03	270-400	17.71
Iron	5.12 ±0.01	12-15	42.67
Sodium	5.98 ±0.01	1600	0.37
Zinc	3.95 ±0.01	12-15	32.92
Manganese	1.55 ±0.01	350	0.44
Copper	0.89 ±0.06	1.7	52.35

4.3.1.4. Microbiological examination of the formulated food mixture No. 1/1:

The formulated food mixture No. 1/1 was tested for total viable bacterial count, molds and yeasts. The obtained results revealed that the total viable bacterial count ranged between less than thirty and 2.57, and the molds and yeasts were less than experimental diets. The presented data in Table (8) appeared that the body weight gain was 17.91% for the group 1 (control), while it was 49.30% for the group 2 (Vitamin B_2 of rat diet was replaced by 25 % of food mixture No. 1/1) and 12.57% for group 3 (diet free of vitamin B_2). It could be seen that the highest significant increase of weight gain ratio was for group 2 compared with control (group 1), while the significant decrease in weight gain ratio was for group 3 compared with control.

It could be concluded that the increase in body weight gain for group 2 was related to the contents of the diet itself which enhanced and increased the ability of food intake. Moreover, food mixture No. 1/1 which had high percentage of carbohydrates affected greatly the body weight, while the decrease in body weight gain for group 3 may be related to using diet free of vitamin B_2.

The food intake and food efficiency (Table, 8) were (26.39, 34.64 and 22.69 gm/day) and (1.97, 4.01 and 1.59%) for groups 1, 2 and 3, respectively. It clearly showed that rats fed on diet containing food mixture No. 1/1 (group 2) had higher food intake and food efficiency, while it lowered for rats fed on diet of group 3 when compared with group 1 (control). The higher intake of foods and food efficiency in the group 2 appeared the quality and ingredients of the diet on food intake, which may be related to differences in diet palatability.

Table (8): Body weight gain, food intake and food efficiency ratio of rats fed on formulated food mixture No.1/1 (Mean ± S.E.)

Group No.	Initial body weight (g)	Final body weight (g)	Body weight gain (g)	Body weight gain (%)	Daily body weight	Food intake (g)	Daily food intake	Food efficiency
G. 1	81.89 ±3.25	96.56 ±2.91	14.67	17.91 ± 0.24	0.52	738.99	26.39	1.97
G. 2	78.84 ±9.71	117.71 ±1.68	38.87	49.30 ± 4.51	1.39	969.82	34.64	4.01
G. 3	79.67 ±13.14	89.69 ±4.11	10.02	12.57 ± 0.02	0.36	635.43	22.69	1.59
LSD				5.21				

Group 1: control

Group 2: Vitamin B_2 was replaced by 25 % of food mixture No. 1/1.

Group 3: Free of vitamin B_2.

b) Organs weight / body weight ratio:

Weight of liver, heart, kidney, brain and spleen of different experimental groups were determined and also organs weight / body weight ratio was calculated. Results are presented in Table (9).

It was noticed from the results that non significant changes was observed for liver, heart, kidney, brain and spleen between group 2 and the control, these meaning that the food mixture No. 1/1 is safety and did not had any effect on the body organs.

On the other hand, it was found a significant change for liver and kidney between group 3 and the control, but any significant change was not observed for heart, brain and spleen between group 3 and the control. These results agree with **Chen *et al.* (1997).**

Table (9): Effect of feeding rats on different diets on weight organs of rats (Mean ± S.E.)

Group No.	Final body weight (g)	Liver		Heart		Kidney		Brain		Spleen	
		Weight (g)	(%)	Weight (g)	(%)	Weight (g)	(%)	Weight (g)	(%)	Weight (g)	(%)
G. 1	96.56	4.11	4.26 ±	0.41	0.42 ±	1.15	1.19 ±	1.26	1.30 ±	0.38	0.39 ±
	±2.91	±0.04	0.02	±0.019	0.01	±0.115	0.07	±0.005	0.005	±0.056	0.03
G. 2	117.71	5.01	4.26 ±	0.51	0.43 ±	1.35	1.15 ±	1.49	1.26 ±	0.48	0.41 ±
	±1.68	±0.85	0.32	±0.061	0.03	±0.99	0.05	±0.089	0.04	±0.098	0.05
G. 3	89.69	3.53	3.93 ±	0.37	0.41 ±	0.92	1.02 ±	1.21	1.35 ±	0.37	0.41 ±
	±4.11	±0.94	0.49	±0.15	0.03	±0.78	0.07	±0.695	0.13	±0.069	0.02
LSD			0.29		0.08		0.12		1.03		1.004

Group 1: control

Group 2: Vitamin B_2 was replaced by 25 % of food mixture No.1/1.

Group 3: Free of vitamin B_2.

c) Biochemical parameters of blood:

1- Liver function enzymes (GPT/ALT) and (GOT/AST) in blood serum of rats fed on different diets:

The effect of different examined diets on the activity of glutamate pyruvate transaminase (GPT) and glutamate oxaloacetate transaminase (GOT) were determined and the results are summarized in Table (10). The results showed that no significant differences in GPT activity between group 2, 3 and group 1 (control) during feeding periods, but there was a significant difference between group 2 and group 3 after 4 weeks. Also, it was observed a high significant difference after one week and two weeks, also, after one week and four weeks of feeding periods in group 3.

The obtained data in Table (10) showed that non-significant difference in GOT between group 2 and the control. Also, it was observed that non-significant difference between group 3 and the control during feeding periods. These results indicated the safety of food mixture No. 1/1 and no sensitive effects was observed for GPT and GOT.

In this concept, **Devlin (1997) and Malacinski and Freifelder (1998)** reported that the enzymes which assayed most commonly in liver diseases cases are glutamate pyruvate transaminase (GPT) and glutamate oxaloacetate transaminase (GOT). Whereas somewhat higher values of serum GPT than GOT are found in acute liver diseases and somewhat lower values in cirrhosis, the differences are not usually great. A similar but less marked pattern (with values rarely above 150 IU/l) usually occurs in necrotic hepatitis and in glandular fever.

Table (10): Liver function enzymes in blood serum of rats fed on different diets (Mean ± S.E.).

Group No.	GPT (μ/L)						
	Fedding peroids (weeks)						
	1		2		4		Mean
	μ/L	%	μ/L	%	μ/L	%	
G. 1	19.00 ± 3.21	100	23.00± 2.64	100	24.66± 3.53	100	22.22 ± 3.13
G. 2	16.17± 4.78	85.10	19.33± 1.33	84.04	20.43± 1.83	82.85	18.64 ± 2.65
G. 3	14.20 ± 1.85	74.74	21.90± 3.93	95.22	26.00± 3.46	105.43	20.70 ± 3.08
Mean	16.46 ± 3.28		21.41 ± 2.63		23.69 ± 2.94		
L.S.D. for time (P<0.05)	5.38						
L.S.D. for groups (P<0.05)	5.38						
L.S.D. for time x groups (P<0.05)	9.32						
	GOT (μ/L)						
G. 1	36.63± 11.74	100	52.90± 10.45	100	53.40± 12.22	100	47.64 ±11.47
G. 2	36.27± 6.80	99.02	38.10± 8.11	72.02	46.27± 9.95	86.65	40.21 ± 8.29
G. 3	44.80± 4.95	122.30	52.80± 3.08	99.81	57.60± 5.86	107.86	51.73 ± 4.63
Mean	39.23 ± 7.83		47.93 ± 7.21		52.42 ± 9.34		
L.S.D. for time (P<0.05)	16.27						
L.S.D. for groups (P<0.05)	16.27						
L.S.D. for time x groups (P<0.05)	28.18						

The initial concentration before feeding (zero time) of :

GPT : 17±2.314 μ/L.

GOT : 33.5±8.47 μ/L .

2- Blood glucose and total cholesterol of rats fed on different diets:

The blood glucose (mg/dl) and total cholesterol (mg/dl) for the blood of different tested rats fed on different diets were determined and the results are shown in Table (11). The data appeared that there was no significant difference in blood glucose could be observed between group 2 and the control, also there was no significant difference in blood glucose between group 3 and the control after one week, but there was a significant difference after two weeks. Meanwhile, it was observed that a significant increase in blood glucose in group 3 after one week and two weeks, also after one week and four weeks of feeding periods.

In this concept, **Ba-Jaber *et al.* (1997)** reported that high carbohydrate high fiber low fat diet had a strong effect on fasting plasma glucose reduction.

On the other hand, from the data in Table (11) it could be shown that no significant difference in total cholesterol between group 2 and the control after one and two weeks, but there was a significant difference after four weeks. Also, it was observed that a significant decrease of total cholesterol in group 2 after one and two weeks and after one and four weeks of feeding period. Meanwhile, there was no significant difference in total cholesterol between group 3 and the control. These results illustrated that the using of food mixture No.1/1had an important effects on the decreasing of total cholesterol. In this concept, **Duane (1997)** found that legume consumption lowers low density lipoprotein (LDL) cholesterol by partially interrupting the enterohepatic circulation of bile acids and increases cholesterol saturation of bile by increasing hepatic secretion of cholesterol.

Table (11): Glucose and total cholesterol in blood serum of rats feeding on experimental diets (Mean ± S.E.).

Group No.	Glucose (mg /dl)						
	Feeding periods (weeks)						
	1		2		4		Mean
	mg/dl	%	mg/dl	%	mg/dl	%	
G. 1	57.01± 6.19	100	59.57± 18.06	100	90.67± 7.69	100	69.08 ± 10.65
G. 2	56.5± 2.13	99.10	73.30± 13.48	123.05	84.86± 19.07	93.59	71.55 ± 11.56
G. 3	62.97± 2.17	110.45	86.77± 5.55	145.66	102.50 ±2.34	113.05	84.08± 3.35
Mean	58.83 ± 3.49		73.21 ± 12.36		92.68± 9.70		
L.S.D. for time (P<0.05)	18.22						
L.S.D. for groups (P<0.05)	18.22						
L.S.D. for time x groups (P<0.05)	31.55						
	Total cholesterol (mg/dl)						
G. 1	110.34± 11.86	100	110.28± 7.35	100	110.25± 6.35	100	110.29 ± 8.52
G. 2	115.43± 24.94	104.61	89.9± 9.79	81.52	88.20± 10.81	80.0	97.84 ± 15.18
G. 3	114.20± 17.08	103.49	117.8± 11.54	106.82	120.0± 12.11	108.84	117.32 ± 13.58
Mean	113.32 ± 17. 96		105.99 ± 9.56		106.15 ± 9.76		
L.S.D. for time (P<0.05)	21.82						
L.S.D. for groups (P<0.05)	21.82						
L.S.D. for time x groups (P<0.05)	39.26						

The initial concentration before feeding (zero time) of :
Glocuse : 56.1±5.09 mg/dl.
Total cholesterol : 110.0±2.56 mg/dl.

4.3.2. Type No. 2 (Food mixtures No. 2/1 and 2/2):

Formulated food mixtures as sources to compensate the deficiency of some minerals (Calcium and phosphorus), were composed from :

2/1 : 49.5 % dry dates + 49.5% defatted peanut + 1% dry yeast

2/2 : 25 % defatted sesame + 25% lentil + 25% termis + 25% fenugreek

4.3.2.1. Chemical composition of formulated food mixtures of type No.2:

The formulated food mixtures of type No. 2 were chemically analysed and the results are recorded in Table (12). The results show that the moisture content of food mixtures No. 2/1 and 2/2 was low at zero time and during storage which ranged from 7.86 to 7.87 and from 6.82 to 6.83%, respectively. The low percentage of moisture in food mixtures No. 2/1 and 2/2 enhanced the preservation capacity and shelf life of the product .

The pH value was ranged from 6.32 to 6.27 and from 6.10 to 5.90 for food mixtures No. 2/1 and 2/2, respectively, while the total acidity was ranged from 0.56 to 0.69 and from 1.09 to 1.21% for mixtures No. 2/1 and 2/2, respectively.

The reducing and total sugars showed low decrease by storage which ranged from 20.81 to 20.80 and from 36.82 to 36.79% for food mixture No. 2/1, respectively, and from 1.04 to 1.03 and from 2.90 to 2.89% for food mixture No. 2/2, respectively, the previous decreases may be related to the non enzymatic browning reaction as found by **Abd El-Fadeel (1981)**

and Ibrahim (1990).

Total free phenolic compounds of food mixtures No. 2/1 and 2/2 was ranged from 0.89 to 0.88 and from 0.21 to 0.20%, respectively, these decreases are very low and may be related to the effect of storage on the changes of free phenolic amino acids to insoluble phenolic compounds through the maillard reaction **(Meyer, 1978).**

On the other hand, the total free amino acids showed low decreases during storage of food mixtures No. 2/1 and 2/2 which ranged from 1.15 to 1.14 and from 0.56 to 0.55%, respectively. These changes may be related to the non-enzymatic browning reaction as found by **Nezam El-Din (1978).**

The crude protein was ranged from 14.62 to 14.60 and from 28.66 to 28.63% for food mixtures No. 2/1 and 2/2, respectively. The high percentage of protein for food mixture No. 2/2 may be related to the high content of raw ingredients consisting this mixture as reported by **King *et al.* (1985), Bahlol (1993) and Raya *et al.* (2000).**

Also, a decrease for crude fiber was found during storage of food mixtures No. 2/1 and 2/2 which ranged from 3.34 to 3.30 and from 5.34 and 5.33%, respectively. Meanwhile, the ash contents of food mixtures No. 2/1 and 2/2 ranged from 2.64 to 2.63 and from 3.62 to 3.60%, respectively. These results are in agreement with the results given by **Abd El-Aal and Rahama (1986), Hasanien, Manal (1994), Ramadan (1995) and Mohamed (2000).**

Table (12): Chemical composition of formulated food mixtures No.2/1and2/2 (Mean ± S.E)

Chemical composition	Mixture No. 2/1				Mixture No. 2/2			
	Storage periods (months)				Storage periods (months)			
	Zero	**3**	**6**	**9**	**Zero**	**3**	**6**	**9**
Moisture (%)	7.86 ±0.003	7.86 ±0.01	7.87 ±0.01	7.87 ±0.005	6.82 ±0.01	6.82 ±0.01	6.83 ±0.01	6.83 ±0.003
pH value	6.32	6.30	6.28	6.27	6.10	6.00	6.00	5.90
Total acidity* (%)	0.56 ±0.001	0.58 ±0.01	0.59 ±0.002	0.69 ±0.001	1.09 ±0.001	1.13 ±0.001	1.13 ±0.001	1.21 ±0.002
Reducing sugars* (%)	20.81 ±0.03	20.80 ±0.01	20.80 ±0.01	20.80 ±0.01	1.04 ±0.02	1.04 ±0.01	1.04 ±0.01	1.03 ±0.02
Total sugars* (%)	36.82 ±0.02	36.81 ±0.03	36.81 ±0.01	36.79 ±0.03	2.90 ±0.01	2.90 ±0.02	2.89 ±0.03	2.89 ±0.02
Total free phenolic compounds*(%)	0.89 ±0.004	0.89 ±0.003	0.89 ±0.002	0.88 ±0.003	0.21 ±0.002	0.20 ±0.002	0.20 ±0.004	0.20 ±0.001
Total free amino acids* (%)	1. 15 ±0.001	1.15 ±0.003	1.14 ±0.002	1.14 ±0.04	0.56 ±0.003	0.56 ±0.002	0.55 ±0.003	0.55 ±0.001
Crude protein* (%)	14.62 ±0.02	14.62 ±0.03	14.60 ±0.01	14.60 ±0.04	28.66 ±0.02	28.66 ±0.01	28.65 ±0.03	28.63 ±0.01
Crude fiber* (%)	3.34 ±0.01	3.31 ±0.04	3.31 ±0.04	3.30 ±0.04	5.34 ±0.02	5.33 ±0.02	5.33 ±0.03	5.33 ±0.02
Ash* (%)	2.64 ±0.002	2.64 ±0.001	2.64 ±0.002	2.63 ±0.002	3.62 ±0.001	3.60 ±0.001	3.60 ±0.003	3.60 ±0.002
Fat* (%)	3.54 ±0.01	3.53 ±0.02	3.52 ±0.02	3.52 ±0.02	6.48 ±0.02	6.47 ±0.01	6.45 ±0.01	6.45 ±0.01
Total carbohydrate* (%)	79.20 ±0.01	79.21 ±0.01	79.24 ±0.02	79.24 ±0.01	61.24 ±0.01	61.27 ±0.005	61.30 ±0.01	61.32 ±0.01
Total Carotenoids * (as β-carotene) (mg/ 100 g)	6.27 ± 0.02	6.14 ± 0.04	6.09 ± 0.02	6.04 ± 0.01	10.76 ± 0.01	10.71 ± 0.02	10.69 ± 0.02	10.68 ± 0.003

*** On dry weight.**

The fat content of food mixtures No. 2/1 and 2/2 was ranged from 3.54 to 3.52 and from 6.48 to 6.45%, respectively, while the total carbohydrate ranged from 79.20 to 79.24 and from 61.24 to 61.32% for food mixtures No. 2/1 and 2/2, respectively, as found in Table (12).

The data in Table (12) show that the total carotenoids of food mixtures No. 2/1 and 2/2 were ranged from 6.27 to 6.04 and from 10.76 to 10.68 mg/100g, respectively. The decreases of total carotenoids during storage for food mixtures No. 2/1 and 2/2 may be related to the degradation of carotenoids as reported by **Afifi (1995) and Mostafa (2002).**

In this occasion, it should be mentioned that during storage of dehydrated foods, there water activity has a significant effect on the stability of nutrients present, β-carotene is lipid-soluble and exhibits its highest stability at intermediate water activities **(Haralampu and Karel, 1983).** Carotenoids are extremely susceptible to degradation. There highly unsaturated structure makes them sensitive to heat, oxygen and light **(Britton, 1992).** There instability is of the almost importance when the objective is to minimize there losses.

4.3.2.2. Minerals content of formulated food mixture No. 2/1 and 2/2:

Minerals content of food mixtures No. 2/1 and 2/2 included major and trace elements, which represented K, P, Ca, Mg, Fe, Na, Zn, Mn and Cu were determined and the results are shown in Table (13).

The obtained data revealed that the minerals content of food mixtures No. 2/1 and 2/2 were 589.04 and 639.08, 203.21 and 480.67, 108.54 and 110.47, 40.22 and 91.36, 3.96 and 9.89, 11.78 and 34.48, 2.13 and 4.81, 1.19 and 1.65 and 0.87 and 1.06 mg/100 g of K, P, Ca, Mg, Fe, Na, Zn, Mn and Cu, respectively. Also, it was observed from the data that food mixture No. 2/2 had high percent of minerals than food mixture No. 2/1. The high content of minerals in food mixture No. 2/2 may be related to the pattern composition of these elements in the original raw materials as reported by **Nour and Magboul (1986), El-Shamery (1988) and Todorov *et al.* (1996).**

On the other hand, it could be observed that the mixtures No. 2/1 and 2/2 could provide the body with 35.7 and 38.7, 16.93 and 40.05, 9.04 and 9.2, 14.9 and 33.8, 33.0 and 82.4, 0.74 and 2.1, 17.7 and 40.1, 0.34 and 0.47 and 51.2 and 62.3% of K, P, Ca, Mg, Fe, Na, Zn, Mn and Cu, respectively, of the daily alloances when serving 100 g of these food mixtures **(NRC, 1980 and WHO, 1985).**

Table (13): Minerals content of formulated food mixtures No.2/1 and 2/2 (on dry weight basis) (Mean ± S.E.).

Minerals	Mixture No. 2/1 (mg/100g)	Mixture No. 2/2 (mg/100g)	Recommended daily requirement (mg)	(%)	
			Adults	Mixture No. 2/1	Mixture No. 2/2
Potassium	589.04 ±0.21	639.08 ±0.03	1650 -1875	35.7	38.7
Phosphorus	203.21 ±0.35	480.67 ±0.03	1200	16.93	40.05
Calcium	108.54 ±0.01	110.47 ±0.03	1200	9.04	9.2
Magnesium	40.22 ±0.01	91.36 ±0.01	270-400	14.9	33.8
Iron	3.96 ±0.02	9.89 ±0.03	12-15	33.0	82.4
Sodium	11.78 ±0.03	34.48 ±0.15	1600	0.74	2.1
Zinc	2.13 ±0.02	4.81 ±0.01	12-15	17.7	40.1
Manganese	1.19 ±0.06	1.65 ±0.01	350	0.34	0.47
Copper	0.87 ±0.003	1.06 ±0.02	1.7	51.2	62.3

4.3.2.3. Microbiological examination of the formulated food mixtures No. 2/1 and 2/2:

The log number of total viable bacterial count and molds and yeasts were determined and the data are shown in Table (14). The results appeared that the total viable bacterial count of food mixtures No. 2/1 and 2/2 during storage was ranged from 3.16 to 3.24 and 3.85 to 3.88, respectively. Also, the total count of molds and yeasts of food mixtures No. 2/1 and 2/2 were ranged from 2.53 to 2.57 and less than fifteen during storage, respectively.

Table (14): Log number of total viable bacterial count, molds and yeasts of formulated food mixtures No.2/1 and 2/2 (per g) (Mean ± S.E.).

Total count	**Mixture No. 2/1**		**Mixture No. 2/2**	
	Storage periods (months)			
	Zero	**9**	**Zero**	**9**
Bacteria	3.16 ±0.33	3.24 ±0.37	3.85 ±0.41	3.88 ±0.39
Molds and yeasts	2.53 ±0.34	2.57 ±0.35	**	**

** **The number less than fifteen .**

The low number of total viable bacterial count, molds and yeasts related to the decreases of moisture contents of these food mixtures, these results were in agreement with those reported by **Ayres *et al.* (1980) and Abd El- Latif (1989)**.

4.3.2.4. Organoleptic evaluation of the formulated food mixtures No. 2/1 and 2/2:

The panel tests were done at zero time and after storage for 9 months for the food mixtures No. 2/1 and 2/2 and the data are presented in Table (15). The results appeared that the highest scores of color, taste and odor were recorded for food mixture No. 2/1 and it was palatable. Also, the food mixture No. 2/2 had high scores for color and odor, so, it's considered palatable, but the taste was acceptable.

On the other hand, it could be observed from the results that there was a significant difference for color between food mixtures No. 2/1 and 2/2 at zero time, but there was not significant difference after storage for 9 months. Also, there was a significant difference for taste and odor between food mixtures No. 2/1 and 2/2 at zero time and after storage for 9 months.

From previous results it is showed that food mixture No. 2/2 was higher in contents than food mixture No.2/1 Food mixture No. 2/2 is considered a good source for some minerals (K, P, Ca, Fe, Mg, Zn and Cu), also it was good source for protein, fiber, ash, fat and total carbohydrate.

Table (15): Organoleptic evaluation of formulated food mixtures No. 2/1 and 2/2 (Mean ± S.E.)

Mixture No.	Color			Taste			Odor		
	Storage periods (months)								
	Zero	9	Mean	Zero	9	Mean	Zero	9	Mean
Mixture No. 2/1	8.83 ±0.07	8.59 ±0.09	8.71 ± 0.08	7.77 ± 0.12	7.61 ±0.15	7.69 ± 0.13	7.73 ±0.11	7.74 ±0.08	7.73 ± 0.09
Mixture No. 2/2	8.57 ±0.01	8.49 ±0.08	8.53 ± 0.04	6.24 ±0.12	6.21 ±0.11	6.22 ± 0.11	7.23 ± 0.12	7.14 ± 0.10	7.18 ± 0.11
Mean	8.70 ± 0.04	8.54 ± 0.08		7.01 ± 0.12	6.91 ± 0.13		7.23 ± 0.11	7.44 ± 0.09	
L.S.D. for time ($P < 0.05$)	0.17			0.26			0.22		
L.S.D. for mixture ($P < 0.05$)	0.17			0.26			0.22		
L.S.D. for time x mixture ($P < 0.05$)	0.24			0.36			0.31		

Palatable = more than 7 .
Acceptable = 5 to 7 .
Unpalatable = less than 5 .

4.3.2.5. Biological evaluation of formulated food mixtures No.2/1 and 2/2 as source to compensate the deficiency of minerals calcium and phosphorus:

a) Body weight gain:

The changes in body weight, body weight gain, food intake and food efficiency of rats fed on experimental diets are presented in Table (16). The results appeared that the highest significant increase of weight gain ratio was found in group 2 (replacing 25% of mineral calcium of rat diet by food mixture No. 2/1 containing 25% of mineral calcium) and group 4 (replacing 10% of mineral phosphorus of rat diet by food mixture No. 2/2 containing 10% of mineral phosphorus) compared with group 1 (control), while the significant decrease of weight gain ratio were found in group 3 (diet free of calcium) and group 5 (diet free of phosphorus) compared with control.

The increase in body weight gain may be related to the increased appetite which reflect the amount of high food intake of groups 2 and 4. Moreover, group 2 and 4 which had high percentage of carbohydrates affected greatly on the body weight, while the decrease in body weight gain for groups 3 and 5 may be related to using diet free of minerals calcium and phosphorus, respectively, these results in agreement with reported by **Ternouth and Sevilla (1984).**

On the other hand, the data in Table (16) show that rats fed on diet containing food mixture No. 2/1 (group 2) and food mixture No. 2/2 (group 4) had higher food intake and food efficiency, while it lowered for rats fed on diet of group 3 and group 5 when compared with control.

Table (16): Body weight gain, food intake and food efficiency ratio of rats fed on experimental diets

(Mean ± S.E.).

Group No.		Initial body weight (g)	Final body weight (g)	Body weight gain (g)	Body weight gain (%)	Daily body weight	Food intake (g)	Daily food intake	Food efficiency
Mixture No. 2/1	G. 1	81.89± 3.25	96.56± 2.91	14.67	17.91 ± 0.24	0.52	738.99	26.39	1.97
	G. 2	82.94± 1.39	126.40± 8.53	43.46	52.39 ± 4.97	1.55	1117.35	39.90	3.88
	G. 3	78.53± 5.68	82.23± 2.47	3.70	4.71 ± 0.20	0.13	589.37	21.05	0.62
LSD					9.96				
Mixture No. 2/2	G. 1	81.89± 3.25	96.56± 2.91	14.67	17.91 ± 0.24	0.52	738.99	26.39	1.97
	G. 4	81.19± 1.27	124.02± 12.66	42.83	52.75 ± 8.10	1.53	997.95	35.64	4.29
	G. 5	79.63± 9.05	81.61± 12.02	1.98	2.49 ± 0.38	0.07	515.69	18.42	0.38
LSD					14.21				

G. 1: control

G. 2: 25% calcium was replaced by food mixture No. 2/1

G. 3: Diet free of calcium

G. 4: 10% phosphorus was replaced by food mixture No. 2/2

G. 5: Diet free of phosphorus.

b) Organs weight / body weight ratio:

Weight of liver, heart, kidney, brain and spleen of different experimental groups were determined and also organs weight / body weight ratio was calculated. Data are presented in Table (17).

From the results in this Table, the mean value of liver weight/ body weight (%) of rats fed on groups 2,4 and 5 diets showed non-significant difference with rats fed on control diet, while rats fed on group 3 diet showed a significant decrease with rats fed on control diet.

On the other hand, the data appeared that all rats fed on the tested diets had non-significant difference of heart ratio when compared with control. The data showed also that the average values of kidney ratio had non significant differences between groups 2, 3 and 4 when compared with control, but there was a significant decrease between group 5 and control.

The results obtained in Table (17) appeared that all rats fed on the tested diets had non-significant difference of brain and spleen ratio when compared with control.

Table (17): Effect of feeding rats on some formulated food mixtures on weight organs of rats (Mean ± S.E.)

Group No.		Final body weight (g)	Liver		Heart		Kidney		Brain		Spleen	
			Weight (g)	(%)	Weight (g)	(%)	Weight (g)	(%)	Weight (g)	(%)	Weight (g)	(%)
Mixture No. 2/1	G. 1	96.56 ±2.91	4.11 ±0.04	4.26 ± 0.02	0.41 ±0.02	0.42 ± 0.01	1.05 ±0.11	1.09 ± 0.07	1.26 ±0.01	1.30 ± 0.005	0.38 ±0.06	0.39 ± 0.03
	G. 2	126.40 ±8.53	5.09 ±0.12	4.03 ± 0.05	0.56 ±0.14	0.44 ± 0.02	1.43 ±0.09	1.13 ± 0.03	1.56 ±0.01	1.23 ± 0.005	0.52 ±0.38	0.41 ± 0.02
	G. 3	82.23 ±0.47	3.06 ±0.65	3.72 ± 0.28	0.32 ±0.08	0.39 ± 0.02	0.86 ±0.39	1.04 ± 0.07	1.17 ±0.39	1.42 ± 0.06	0.33 ±0.09	0.40 ± 0.03
LSD				**0. 51**		**0.05**		**0.21**		**1.004**		**1.002**
Mixture No. 2/2	G. 1	96.56 ±2.91	4.11 ±0.04	4.26 ± 0.02	0.41 ±0.02	0.42 ± 0.01	1.05 ±0.11	1.09 ± 0.07	1.26 ±0.01	1.30 ± 0.005	0.38 ±0.06	0.39 ± 0.03
	G. 4	124.02 ±12.66	5.02 ±0.09	4.05 ± 0.04	0.52 ±0.05	0.42 ± 0.02	1.38 ±0.10	1.11 ± 0.05	1.51 ±0.03	1.22 ± 0.01	0.54 ±0.07	0.43 ± 0.03
	G. 5	81.61 ±5.22	3.26 ±0.61	3.99 ± 0.23	0.31 ±0.01	0.38 ± 0.01	0.81 ±0.02	0.99 ± 0.01	1.18 ±0.06	1.44 ± 0.04	0.32 ±0.09	0.39 ± 0.02
LSD				**0.47**		**0.04**		**0.05**		**1.002**		**1.002**

Group 1: control.
Group 2: 25% calcium replaced by food mixture No. 2/1.
Group 3: Diet free of calcium.
Group 4: 10% Phosphorus replaced by food mixture No. 2/2.
Group 5: Diet free of phosphorus.

c) Biochemical parameters of blood:

1- Liver function enzymes (GPT/ALT) and (GOT/AST) in blood serum of rats fed on different diets:

The effect of different examined diets on the activity of glutamate pyruvate transaminase (GPT) and glutamate oxaloactate transaminase (GOT) were determined and the results are presented in Table (18).

The results show that non-significant differences in GPT activity between all groups and the control during feeding periods, but there was a significant difference after one week and four weeks of feeding period in groups 3, 4 and 5. Also, the data appeared that no significant differences in GOT activity between all groups and the control during feeding periods.

In this concern, **Abd El-Salam and Abd El-Megeid (1998)** reported that feeding on fenugreek diets decreased serum AST and ALT in hyperglycemic rats.

Table (18): Liver function enzymes in blood serum of rats fed on different formulated food mixtures (Mean ± S.E.).

Group No.		GPT (µ / L)							GOT (µ / L)						
		Feeding periods (weeks)						Mean	Feeding periods (weeks)						Mean
		1		2		4			1		2		4		
		µ/L	%	µ/L	%	µ/L	%		µ/L	%	µ/L	%	µ/L	%	
Mixture No. 2/1	G. 1	19.00± 3.21	100	23.00± 2.64	100	24.66± 3.53	100	22.22 ± 3.13	36.63± 11.74	100	52.90± 10.45	100	53.40± 12.22	100	47.64 ± 11.47
	G. 2	18.33± 5.55	96.47	19.13± 4.77	83.17	22.70± 1.76	92.05	20.05 ± 4.03	39.20± 11.80	107.02	49.70± 7.85	93.95	51.60± 10.10	96.62	46.83 ± 9.88
	G. 3	22.00± 0.58	115.79	22.00± 2.31	95.65	27.70± 2.40	112.33	23.90 ± 1.76	40.60± 10.19	110.84	44.20± 0.63	83.55	53.70± 2.45	100.56	46.17 ± 7.86
Mean		19.78 ± 3.11		21.38 ± 3.24		25.03 ± 2.56			38.80 ± 11.24		48.93 ± 6.28		52.9 ± 8.26		
L.S.D. for time (P < 0.05)		5.65							17.15						
L.S.D. for groups (P < 0.05)		5.65							17.15						
L.S.D. for time x groups (P < 0.05)		9.79							29.71						
Mixture No. 2/2	G. 1	19.00± 3.21	100	23.00± 2.645	100	24.66± 3.53	100	22.22 ± 3.13	36.63± 11.74	100	52.90± 10.45	100	53.40± 12.22	100	47.64 ± 11.47
	G. 4	14.40± 1.95	75.79	15.90± 1.58	69.13	21.33± 3.75	86.49	17.21 ± 2.43	33.80± 4.02	92.27	50.60± 10.99	95.65	52.01± 8.001	97.39	45.47 ± 7.67
	G. 5	17.80± 1.46	93.68	21.30± 4.58	92.61	26.33± 6.38	106.77	21.81 ± 4.14	49.40± 11.65	134.86	51.60± 9.16	97.54	58.20± 6.08	108.98	53.07 ± 8.96
Mean		17.07 ± 2.21		20.07 ± 2.93		24.11 ± 4.55			39.94 ± 9.14		51.70 ± 10.2		54.54 ± 8.77		
L.S.D. for time (P < 0.05)		6.05							17.03						
L.S.D. for groups (P < 0.05)		6.05							17.03						
L.S.D. for time x groups (P < 0.05)		10.48							29.49						

The initial concentration before feeding (Zero time) of :

GPT : 17±2.314 µ/L.

GOT : 33.5±8.44 µ/L.

2- Blood glucose and total cholesterol of rats fed on different diets:

The blood glucose (mg/dI) and total cholesterol (mg/dI) for the blood of different tested rats fed on different diets were determined and the data are presented in Table (19).

The data appeared that no significant differences of glucose levels in serum between groups 2, 3 and group 1 (control). Also, the results showed no significant differences of glucose levels between group 4 and control during feeding periods, while it was found a significant differences between group 5 and control after one week, but there was no significant differences after two and four weeks.

In this concern, result in Table (19) indicat that glucose level in plasma of investigated rats during feeding periods. These values are within the normal range of glucose in adult rats plasma according to **(Jiro, 1987)** which reported that the range of glucose in fasted rats was (47.73 – 100.98 mg/100 ml), mean value was (73.33 mg/100 ml).

On the other hand, the results in Table (19) show that no significant difference in total cholesterol between groups 2, 3 and the control. Meanwhile, it was observed from the results that no significant difference in total cholesterol between group 4 and the control after one and two week, but there was high significant decrease in total cholesterol after four weeks of feeding periods, also it was found that high significant decrease of total cholesterol in group 4 after one and four weeks of feeding periods. No significant difference was observed in total cholesterol between group 5 and the control during all feeding periods.

Previous results are very important which indicated to the good value of mixture No. 2/2 on the lowering of total cholesterol. **Rashwan (1994)** found that the highest percent of drop in serum total cholesterol at the end of feeding period was exerted by lupines protein (37.2%), followed by fenugreek / lupines mixed protein (32.1%), then came lentiuls / lupines mixed protein and fenugreek protein with drop amounted to 30.8% and 29.7%, respectively.

Table (19): Glucose and total cholesterol in blood serum of rats fed on different formulated food mixtures (Mean + S.E.).

Group No.		Glucose (mg/dl)							Total cholesterol (mg/dl)						
		Feeding periods (weeks)						Mean	Feeding periods (weeks)						Mean
		1		2		4			1		2		4		
		mg/dl	%	mg/dl	%	mg/dl	%		mg/dl	%	mg/dl	%	mg/dl	%	
Mixture No. 2/1	G. 1	57.01± 6.19	100	59.57 ± 18.06	100	90.67± 7.69	100	69.08 ± 10.65	110.34 ± 11.86	100	110.28 ± 7.35	100.	110.25± 6.35	100	110.29± 8.52
	G. 2	63.20± 9.26	110.86	64.12 ± 2.65	107.64	90.30± 5.39	99.59	72.54 ± 5.77	109.80 ± 36.62	99.51	99.83 ± 36.68	90.52	93.43 ± 26.09	84.74	101.02± 33.13
	G. 3	62.20± 1.95	109.10	69.40± 7.39	116.5	96.0 ± 9.83	105.88	75.87 ± 6.39	106.49± 17.55	96.51	102.83 ± 17.96	93.24	99.73± 12.39	90.46	103.02± 15.97
Mean		60.80 ± 5.80		64.36 ± 9.37		92.32 ± 7.64			108.88 ± 22.01		104.31 ± 20.66		101.14 ± 14.94		
L.S.D. for time (P < 0.05)		22.57							41.87						
L.S.D. for groups (P < 0.05)		22.57							41.87						
L.S.D. for time x groups (P < 0.05)		39.09							72.52						
Mixture No. 2/2	G. 1	57.01± 6.19	100	59.57± 18.06	100	90.67± 7.69	100	69.08 ± 10.65	110.34± 11.86	100	110.28 ± 7.35	100	110.25 ± 6.35	100	110.29 ± 8.52
	G. 4	50.1 ± 11.35	87.88	57.60± 1.85	96.69	93.3 ± 8.29	102.90	67.00 ± 7.16	108.06 ± 18.98	97.93	93.47 ± 17.49	84.76	81.59 ± 6.54	74.00	94.37± 14.34
	G. 5	34.17± 1.61	59.94	56.87 ± 0.63	95.47	95.9± 14.73	105.77	62.31 ± 5.66	113.97± 12.53	103.29	101.53 ± 15.30	92.06	98.77 ± 13.94	89.59	104.76 ± 13.92
Mean		47.09 ± 6.38		58.01 ± 6.85		93.29 ± 10.24			110.79± 14.46		101.76 ± 13.38		96.87 ± 8.94		
L.S.D. for time (P < 0.05)		16.62							21.44						
L.S.D. for groups (P < 0.05)		16.62							21.44						
L.S.D. for time x groups (P < 0.05)		28.79							37.14						

The initial concentration before feeding (Zero time) of :

Glucose : 56.1 + 5.09 mg/dl.

Total cholesterol : 110.0 + 2.56 mg/dl.

cholesterol between group 5 and the control during all feeding periods.

Previous results are very important which indicated to the good value of mixture No. 2/2 on the lowering of total cholesterol. **Rashwan (1994)** found that the highest percent of drop in serum total cholesterol at the end of feeding period was exerted by lupines protein (37.2%), followed by fenugreek / lupines mixed protein (32.1%), then came lentiuls / lupines mixed protein and fenugreek protein with drop amounted to 30.8% and 29.7%, respectively.

Table (19): Glucose and total cholesterol in blood serum of rats fed on different formulated food mixtures (Mean ± S.E.).

Group No.		Glucose (mg/dl)							Total cholesterol (mg/dl)						
		Feeding periods (weeks)						Mean	Feeding periods (weeks)						Mean
		1		2		4			1		2		4		
		mg/dL	%	mg/dL	%	mg/dL	%		mg/dL	%	mg/dL	%	mg/dL	%	
Mixture No. 2/1	G. 1	57.01± 6.19	100	59.57 ± 18.06	100	90.67± 7.69	100	69.08 ± 10.65	110.34 ± 11.86	100	110.28 ± 7.35	100	110.25± 6.35	100	110.29± 8.52
	G. 2	63.20± 9.26	110.86	64.12 ± 2.65	107.64	90.30± 5.39	99.59	72.54 ± 5.77	109.80 ± 36.62	99.51	99.83 ± 36.68	90.52	93.43 ± 26.09	84.74	101.02± 33.13
	G. 3	62.20± 1.95	109.10	69.40± 7.39	116.5	96.0 ± 9.83	105.88	75.87 ± 6.39	106.49± 17.55	96.51	102.83 ± 17.96	93.24	99.73± 12.39	90.46	103.02± 15.97
Mean		60.80 ± 5.80		64.36 ± 9.37		92.32 ± 7.64			108.88 ± 22.01		104.31 ± 20.66		101.14 ± 14.94		
L.S.D. for time (P < 0.05)		22.57							41.87						
L.S.D. for groups (P < 0.05)		22.57							41.87						
L.S.D. for time x groups (P < 0.05)		39.09							72.52						
Mixture No. 2/2	G. 1	57.01± 6.19	100	59.57± 18.06	100	90.67± 7.69	100	69.08 ± 10.65	110.34± 11.86	100	110.28 ± 7.35	100	110.25 ± 6.35	100	110.29 ± 8.52
	G. 4	50.1 ± 11.35	87.88	57.60± 1.85	96.69	93.3 ± 8.29	102.90	67.00 ± 7.16	108.06 ± 18.98	97.93	93.47 ± 17.49	84.76	81.59 ± 6.54	74.00	94.37± 14.34
	G. 5	34.17± 1.61	59.94	56.87 ± 0.63	95.47	95.9± 14.73	105.77	62.31 ± 5.66	113.97± 12.53	103.29	101.53 ± 15.30	92.06	98.77 ± 13.94	89.59	104.76 ± 13.92
Mean		47.09 ± 6.38		58.01 ± 6.85		93.29 ± 10.24			110.79± 14.46		101.76 ± 13.38		96.87 ± 8.94		
L.S.D. for time (P < 0.05)		16.62							21.44						
L.S.D. for groups (P < 0.05)		16.62							21.44						
L.S.D. for time x groups (P < 0.05)		28.79							37.14						

The initial concentration before feeding (Zero time) of :

Glucose : 56.1 ± 5.09 mg/dl.

Total cholesterol : 110.0 ± 2.56 mg/dl.

3- Calcium and phosphorus in blood serum of rats fed on different diets:

The calcium and phosphorus contents in blood serum of rats fed on different diets were determined and the results are presented in Table (20). The results appeared that no significant difference of calcium in blood serum between group 2 and the control, but there was a high significant decrease of calcium in blood serum between group3 and the control. Also, data in Table (20) shown a high decrease of calcium in blood serum in group 3 after one and two weeks of feeding periods.

On the other hand, results in Table (20) showed no significant difference of phosphorus in blood serum between group 4 and the control, also there was no significant difference between group 5 and the control after one and two weeks of feeding periods, but a high significant decrease of phosphorus in blood serum was observed after four weeks. Meanwhile, it was observed a high significant difference of phosphorus in blood serum in group 5 after one and four weeks of feeding periods.

The previous results clarified the importance of these mixtures as natural foods to remove the deficiency of calcium and phosphorus as reported by **Harcourt-Brown (1996), Cui and Iuo (1997) and Fischer *et al.* (1999).**

Table (20): Calcium and Phosphorus in blood serum of rats fed on different diets (Mean + S.E.).

Group No.		Calcium (mg /dl)			
		Feeding periods (weeks)			
		1	2	4	Mean
Mixture No. 2/1	G.1	53.02±8.54	54.57±11.06	56.87±18.19	54.82 ± 12.59
	G.2	61.38±6.41	69.90±0.83	72.4±13.62	67.89 ± 6.95
	G.3	21.59±5.80	6.36±3.19	0.00±0.00	9.32 ±2.99
Mean		45.33 ±6.92	43.61 ± 5.03	43.09 ± 10.60	
L.S.D. for time (P<0.05)		16.14			
L.S.D. for groups (P<0.05)		16.14			
L.S.D. for time x groups (P<0.05)		27.56			
		Phosphors (mg / dl)			
Mixture No. 2/2	G.1	17.95±1.09	18.80±1.88	19.28±2.83	18.68 ± 1.93
	G.4	18.98±5.06	21.15±1.60	24.32±1.68	21.48 ± 2.78
	G.5	16.45±1.81	15.55±0.58	6.98±1.26	12.99 ±1.22
Mean		17.79 ± 2.65	18.50 ± 1.35	16.86 ± 1.92	
L.S.D. for time (P<0.05)		5.48			
L.S.D. for groups (P<0.05)		5.48			
L.S.D. for time x groups (P<0.05)		10.02			

The initial concentration before feeding (zero time) of :
Calcium : 52.13+ 5.16 mg/dl
Phosphorus : 17.01+2.003 mg/dl .

4.3.3. Type No.3 (Food mixtures No.3/1 and 3/2)

Formulated food mixtures as sources to compensate the deficiency of iron and vitamins (B_{12} and folic acid), were composed from :

3/1 : 33% dry dates +33% lentil + 33% guava + 1% dry yeast .

3/2 : 43% guava pulp + 43% orange + 7% dry dates + 7% fenugreek.

4.3.3.1. Chemical composition of formulated food mixtures of type No. 3:

The chemical composition of food mixtures No. 3/1 and 3/2 illustrated that: the moisture content of food mixtures No. 3/1 and 3/2 was law at zero time and during storage which resulted from the dehydration of raw materials (Table, 21).

The pH values of food mixtures No. 3/1 and 3/2 ranged from 4.9 to 5 and from 5.21 to 5.15, respectively, while the total acidity ranged from 1.28 to 1.27 and from 1.08 to 1.16%, respectively.

The reducing and total sugars of food mixtures No. 3/1 and 3/2 were decreased gradually by storage which ranged from 18.57 to 18.56 and from 34.71 to 34.61% for food mixture No. 3/1, respectively, and from 24.84 to 24.79 and from 43.92 to 43.76% for food mixture No.3/2, respectively. The decreases of reducing and total sugars may be related to the reaction between reducing sugars and free amino acids **(Ibrahim, 1990).** The percentage of reducing and total sugars of food mixtures No. 3/1 and 3/2 were high (Table, 21) which related to the high sugars content of raw materials as found by **El-Sherbiny and Rizk (1981), Sood *et al.* (1982), Ramadan (1995), Raya *et al.* (2000) and Abo-Zaid (2002).**

Total free phenolic compounds was ranged from 0.92 to 0.91 and from 1.39 to 1.38% for food mixtures No. 3/1 and 3/2, respectively, the previous decreases of total free phenolic compounds during storage may be related to the maillard reaction **(Ragab, 1987).** Also, the free amino acids showed a slight changes during storage for food mixtures No. 3/1 and 3/2 (Table, 21) which ranged from 1.04 to 1.03 and from 1.39 to 1.37 %, respectively, these changes could be related to the non-enzymatic browning as reported by **Meyer (1978).**

On the other hand, the results in Table (21) show that the crude protein of food mixtures No. 3/1 and 3/2 was ranged from 10.93 to 10.92 and from 7.12 to 7.11%, respectively. Also, it was not observed that any changes of crude fiber for mixtures No. 3/1 and 3/2, but there was low decreases for ash during storage.

The fat content of food mixtures No. 3/1 and 3/2 was 0.83 and 2.05% at zero time, respectively. It did not show any changes after storage periods, the low content of fat in these food mixtures related to the low content of fat in the raw materials. The total carbohydrate showed a high percentages in food mixtures No. 3/1 and 3/2 (Table, 21) which ranged from 85.62 to 85.64 and from 87.56 to 87.58%, respectively. The high content of total carbohydrate related to the high sugars content of raw materials.

Table (21): Chemical composition of some formulated food mixtures No.3/1and 3/2 (Mean ± S.E)

Chemical composition	Mixture No. 3/1				Mixture No. 3/2			
	Storage periods (months)				Storage periods (months)			
	Zero	3	6	9	Zero	3	6	9
Moisture (%)	5.20 ±0.001	5.21 ±0.003	5.22 ±0.005	5.22 ±0.002	8.48 ±0.002	8.48 ±0.005	8.48 ±0.002	8.48 ±0.003
pH value	4.90	4.90	4.90	5.00	5.21	5.20	5.15	5.15
Total acidity* (%)	1.28 ±0.002	1.28 ±0.001	1.28 ±0.001	1.27 ±0.002	1.08 ±0.001	1.09 ±0.002	1.15 ±0.002	1.16 ±0.001
Reducing sugars* (%)	18.57 ±0.03	18.57 ±0.05	18.56 ±0.03	18.56 ±0.02	24.84 ±0.02	24.83 ±0.02	24.81 ±0.01	24.79 ±0.01
Total sugars* (%)	34.71 ±0.04	34.68 ±0.01	34.65 ±0.02	34.61 ±0.02	43.92 ±0.03	43.86 ±0.02	43.79 ±0.03	43.76 ±0.01
Total free phenolic compounds*(%)	0.92 ±0.001	0.92 ±0.001	0.92 ±0.004	0.91 ±0.01	1.39 ±0.002	1.39 ±0.001	1.39 ±0.003	1.38 ±0.002
Total free amino acids* (%)	1.04 ±0.001	1.04 ±0.003	1.03 ±0.01	1.03 ±0.01	1.39 ±0.003	1.38 ±0.004	1.37 ±0.01	1.37 ±0.002
Crude protein* (%)	10.93 ±0.021	10.92 ±0.02	10.92 ±0.01	10.92 ±0.02	7.12 ±0.001	7.12 ±0.01	7.11 ±0.01	7.11 ±0.02
Crude fiber* (%)	4.84 ±0.015	4.84 ±0.02	4.84 ±0.004	4.84 ±0.01	7.89 ±0.003	7.89 ±0.01	7.89 ±0.004	7.89 ±0.01
Ash* (%)	2.62 ±0.002	2.62 ±0.003	2.61 ±0.002	2.61 ±0.001	3.27 ±0.002	3.27 ±0.002	3.27 ±0.001	3.26 ±0.001
Fat* (%)	0.83 ±0.001	0.83 ±0.003	0.83 ±0.005	0.83 ±0.003	2.05 ±0.001	2.05 ±0.003	2.05 ±0.002	2.05 ±0.002
Total carbohydrate* (%)	85.62 ±0.02	85.63 ±0.02	85.64 ±0.01	85.64 ±0.01	87.56 ±0.02	87.56 ±0.01	87.57 ±0.02	87.58 ±0.015
Total carotenoids* (as- β-carotene) (mg / 100 g)	14.81 ± 0.05	14.79 ± 0.03	14.74 ± 0.05	14.73± 0.60	6.33 ± 0.01	6.32 ± 0.01	6.32 ± 0.02	6.31 ± 0.04

* On dry weight.

The total carotenoids of food mixtures No.3/1 and 3/2 was ranged from 14.81 to 14.73 and from 6.33 to 6.31 mg/100 g, respectively. The decrease of total carotenoids during storage may be related to the degradation of carotenoids as found by **Abd El-Fadeel (1981).**

4.3.3.2. Vitamins content of the formulated food mixtures No. 3/1 and 3/2

The vitamins B_{12} and folic acid content of the formulated food mixtures No. 3/1 and 3/2 are presented in Table (22) and it could be observed that the vitamins B_{12} and folic acid contents of food mixtures No. 3/1 and 3/2 at zero time and after storage for 9 months were ranged from 16.8 to 16.03, from 12.32 to 12.30, from 120.2 to 106.5 and from 204.3 to 177.01 μg/100 g, respectively. The decrease of vitamins content during storage (Table, 22) may be related to oxidation of these vitamins as reported by **Gregory (1985).**

On the other hand, it could be observed from the results (Table, 22) that food mixtures No. 3/1 and 3/2 could be considerd as an excellent source for vitamin B_{12}. With regared to the sources of folic acid, mixture No. 3/2 causes first followed by mixture No. 3/1 on the bases of the daily requirements **(WHO, 1985).** So, these food mixtures could be used for treating the deficiency of vitamins B_{12} and folic acid.

Table (22): Vitamins content of formulated food mixtures No. 3/1 and 3/2 (on dry weight basis).

Vitamins content	**Mixture No. 3/1**		**Mixture No. 3/2**		**Recommended daily requirements**	**(%)**	
	Storage periods (months)						
	Zero	**9**	**Zero**	**9**	**Adults**	**Mixture No. 3/1**	**Mixture No. 3/2**
B_{12} (µg/100g)	16.8	16.03	12.32	12.30	2	840	616
folic acid (µg/100g)	120.2	106.5	204.3	177.01	150-200	80.1	136.2

4.3.3.3.Minerals content of the formulated food mixtures No. 3/1 and 3/2:

The minerals content of food mixtures No.3/1 and 3/2 were determined and the data are shown in Table (23). From the results it could be considerd as a good source of minerals potassium, phosphorus, magnesium and copper when compared with food mixture No.3/2. On the other hand food mixture No. 3/2 could be considerd as a good source of minerals calcium, iron, sodium and zinc.

From the results, one hundred grams of the food mixtures No. 3/1 and 3/2 offered 48.3 and 38.8% of daily requirements of potassium, 14.04 and 10.7% of phosphorus, 6.01 and 14.3% of calcium, 21.4 and 18.5% of magnesium, 40.3 and 44.6% of iron, 14.1 and 23.9% of zinc and 65.9 and 59.4% of copper, respectively, and low levels of sodium and manganese which were 1.4 and 2.1, 0.38 and 0.17%, respectively, when compared to recommended daily requirements os adults **(WHO, 1985 and FNB, 1989).**

4.3.3.5. Organoleptic evaluation of the formulated food mixtures No. 3/1 and 3/2:

The panel tests of formulated food mixtures No. 3/1 and 3/2 were determined and the data summarized in Table (25). The data indicated that the highest score of color, taste and odor were recorded for food mixture No. 3/1, so it could be considered palatable. On the other hand, the color, taste and odor of food mixture No. 3/2 had low score than food mixture No. 3/1, and it's color was palatable, while its taste and odor were considered acceptable.

Also, the results show that there was high significant difference for color, taste and odor between food mixtures No. 3/1 and 3/2 at zero time and after storage for 9 months. The higher scores of quality for food mixture No.3/1 than food mixture No. 3/2 may be related to the high quality of raw materials which composed these food mixtures.

From previous results it was appeared that the formulated food mixtures No. 3/1 and 3/2 were considered as a very good source of vitamins B_{12} and folic acid, as well as for some minerals (potassium, phosphorus, iron, zinc and copper). Meanwhile, it was observed from the results that food mixture No. 3/2 was more better than food mixture No. 3/1 because it was rich in some ingredient such as reducing sugars, total sugars and total carbohydrate.

Table (25): Organoleptic evaluation of formulated food mixtures No. 3/1 and 3/2 (Mean ± S.E.)

Mixture No.	Color			Taste			Odor		
	Storage periods (months)								
	Zero	9	Mean	Zero	9	Mean	Zero	9	Mean
Mixture No. 3/1	9.17 ± 0.09	9.13 ± 0.08	9.15 ± 0.08	7.53 ± 0.11	7.38 ± 0.11	7.45 ± 0.11	8.82 ± 0.11	8.62 ± 0.11	8.72 ± 0.11
Mixture No. 3/2	7.17 ± 0.13	7.03 ± 0.08	7.10 ± 0.10	6.14 ± 0.08	6.09 ± 0.07	6.11 ± 0.07	6.80 ± 0.09	6.73 ± 0.12	6.76 ± 0.10
Mean	8.17 ± 0.11	8.08 ± 0.08		6.83 ± 0.09	6.73 ± 0.09		7.81 ± 0.10	7.67 ± 0.11	
L.S.D. for time ($P < 0.05$)	0.21			0.19			0.22		
L.S.D. for mixture ($P < 0.05$)	0.21			0.19			0.22		
L.S.D. for time x mixture ($P < 0.05$)	0.29			0.28			0.32		

Palatable = more than 7 .

Acceptable = 5 to 7.

Unpalatable = less than 5 .

4.3.3.5. Biological evaluation of formulated food mixture as source to compensate the deficiency of mineral iron:

a) Body weight gain:

The changes in body weight, body weight gain, food intake and food efficiency of rats fed on experimental diets are shown in Table (26). The data indicate that the highest significant increase of weight gain ratio was found in group 2 (replacing 25% of mineral iron of rat diet by food mixture No. 3/2 containing 25% of mineral iron) compared with group 1 (control). On the other hand group 3 (diet free of iron) resulted in a significant decrease of weight gain ratio compared with the control.

It could be concluded that the increase in body weight gain for group 2 may be related to the high contents of fiber and total carbohydrate in mixture No. 3/2 which affected greatly the body weight. The decrease in body weight gain for group 3 may be related to using diet free of mineral iron. In this occasion, **Aro *et al.* (1984) and Madar and Odes (1990)** did not show any difference in weight in experimentral animals or humans chronically fed on high fiber diets, the low caloric density of the diet was compensated by a higher intake. Moreover, **Mongeau *et al.* (1991)** found that diets containing purified cellulose, oat bran, wheat bran had a transient effect on the body weight gain.

The food intake and food efficiency as found in Table (26) showed that rats fed on diet containing food mixture No. 3/2 (group 2) had higher food intake and food efficiency, while it was lowered for rats fed on diet of group 3 when compared with the control.

Table (26): Body weight gain, food intake and food efficiency ratio of rats fed on formulated food mixture No. 3/2 (Mean ± S.E.)

Group No.	Initial body weight (g)	Final body weight (g)	Body weight gain (g)	Body weight gain (%)	Daily body weight	Food intake (g)	Daily food intake	Food efficiency
Group 1	81.89 ±3.25	96.56 ±2.91	14.67	17.91 ± 0.24	0.52	738.99	26.39	1.97
Group 2	82.89 4.93±	113.47 ±7.35	30.58	36.89 ± 1.69	1.09	938.28	33.51	3.25
Group 3	77.50 ±11.35	77.52 ±3.11	0.02	0.02 ± 0.01	0.001	482.47	17.23	0.006
LSD				3.40				

Group 1: control

Group 2: 25% iron was replaced by food mixture No. 3/2.

Group 3: A diet free of iron.

b) Organs weight / body weight ratio:

Weight of liver, heart, kidney, brain and spleen of different experimental groups were determined and also organs weight / body weight ratio was calculated. The results are shown in Table (27).

There was non-significant difference with rats fed on control diet and group 2, while rats fed on group 3 diet showed a significant decrease with rats fed on control diet.

On the other hand, the data obtained in Table (27) show that all rats fed on groups 2 and 3 diets had non-significant difference of heart, kidney and brain when compared with the control. Meanwhile, the mean value of spleen weight / body weight (%) of rats fed on group 2 diet had no-significant difference with rats fed on control diet, while rats fed on group 3 diet showed a significant difference with rats fed on control diet. These results are in agreement with those reported by **Abd El-Salam and Abd El-Megeid (1998) and Lehninger *et al.* (1993).**

Table (27): Effect of feeding rats on formulated food mixture No.3/2 on weight organs of rats (Mean ± S.E.)

Group No.	Final body weight (g)	Liver		Heart		Kidney		Brain		Spleen	
		Weight (g)	(%)	Weight (g)	(%)	Weight (g)	(%)	Weight (g)	(%)	Weight (g)	(%)
Group 1	96.56 ±2.91	4.11 ±0.04	4.26 ± 0.02	0.41 ±0.02	0.42 ± 0.01	1.05 ±0.11	1.09 ± 0.07	1.26 ±0.005	1.30 ± 0.005	0.38 ±0.06	0.39 ± 0.03
Group 2	113.47 ±7.35	4.38 ±0.53	3.86 ± 0.12	0.44 ±0.05	0.39 ± 0.01	1.27 ±0.38	1.12 ± 0.10	1.45 ±0.52	1.28 ± 0.01	0.49 ±0.08	0.43 ± 0.01
Group 3	77.52 ±3.11	2.68 ±0.67	3.46 ± 0.46	0.32 ±0.08	0.41 ± 0.01	0.91 ±0.06	1.17 ± 0.04	1.15 ±0.72	1.48 ± 0.24	0.23 ±0.06	0.29 ± 0.02
LSD			**0.75**		**0.04**		**1.02**		**1.08**		**0.06**

Group 1: control.

Group 2: 25% iron was replaced by food mixture No.3/2.

Group 3: A diet free of iron.

c) Biochemical parameters of blood:

1- Liver function enzymes (GPT/ALT) and (GOT/AST) in blood serum of rats fed on different diets:

The effect of different examined diets on the activity of glutamate pyruvate transaminase (GPT) and glutamate oxaloacetate transaminase (GOT) were determined and the results are summarized in Table (28). The results showed that there was no significant differences in GPT activity between group 2 and the control during feeding periods. Also, there was no significant difference in GPT activity between group 3 and the control after one and two weeks. On the other hand, there was a significant difference after four weeks, which agreement with what has been reported by **Abd El-Salam and Abd El-megeid (1998).** In addition, there was a significant difference of GPT activity in group 3 after one and two weeks, and after two and four weeks.

The results also indicate that there was no significant differences in GOT activity between group 2, 3 and the control during all feeding periods.

Table (28): Liver function enzymes in blood serum of rats fed on experimental diets (Mean ± S.E.).

Group No.	GPT (µ /L)						
	Feeding periods (weeks)						
	1		2		4		Mean
	µ /L	%	µ /L	%	µ /L	%	
G. 1	19.00± 3.21	100	23.00± 2.64	100	24.66± 3.53	100	22.22 ± 3.13
G. 2	15.33± 6.56	80.68	23.00± 6.79	100	24.50 ± 3.76	99.35	20.94 ± 5.70
G. 3	16.30± 0.91	85.79	21.40± 1.40	93.04	29.69 ± 3.65	120.39	22.46 ± 1.99
Mean	16.88 ± 3.56		22.47 ± 3.61		26.28 ± 3.65		
L.S.D. for time (P<0.05)	4.99						
L.S.D. for groups (P<0.05)	4.98						
L.S.D. for time x groups (P<0.05)	8.10						
	GOT (µ /L)						
G. 1	36.63± 11.74	100	52.90± 10.45	100	53.40± 12.22	100	47.64 ± 11.47
G. 2	44.46± 10.66	121.37	48.70± 5.59	92.06	51.80± 4.09	97.00	48.32 ± 6.78
G. 3	46.00± 7.08	125.58	52.13± 14.04	98.54	54.30± 2.25	101.68	50.81 ± 7.79
Mean	42.36 ± 9.83		51.24 ± 10.03		53.17 ± 6.19		
L.S.D. for time (P<0.05)	16.28						
L.S.D. for groups (P<0.05)	16.28						
L.S.D. for time x groups (P<0.05)	28.20						

The initial concentration before feeding (zero time) of :

GPT : 17±2.314 µ/L.

GOT : 33.5±8.44 µ/L.

2- Blood glucose and total cholesterol of rats on different diets:

The results of blood glucose and total cholesterol of rats which were fed on different diets are summarized in Table (29), and the data show that there was no significant differences in blood glucose between groups 2, 3 and the control during all feeding periods.

On the other hand, the results appeared that a high significant decrease in total cholesterol between group 2 and the control after one, two and four weeks of feeding periods, while there was no significant difference in total cholesterol between group 3 and the control after all feeding periods. These results are in agreement with those reported by **Lehninger *et al.* (1993), Rashwan (1994) and Duane (1997).**

Table (29): Glucose and total cholesterol content in blood serum of rats fed on experimental diets (Mean ± S.E.).

Group No.	Glucose (mg/dl)						
	Feeding periods (weeks)						
	1		2		4		Mean
	mg/dl	%	mg/dl	%	mg/dl	%	
G. 1	57.01± 6.19	100	59.57± 18.06	100	90.67± 7.69	100	69.08 ± 10.65
G. 2	60.30± 11.09	105.77	66.70± 1.44	111.97	96.30± 7.39	106.21	74.43 ± 6.64
G. 3	59.7± 3.88	104.72	64.00± 7.53	107.44	89.5± 1.95	98.71	71.07 ± 4.45
Mean	59.00 ± 7.05		63.42± 9.01		92.16 ± 5.68		
L.S.D. for time (P<0.05)	14.90						
L.S.D. for groups (P<0.05)	14.90						
L.S.D. for time x groups (P<0.05)	25.81						
	Total cholesterol (mg/dl)						
G. 1	110.34 ± 11.86	100	110.28 ± 7.35	100	110.25± 6.35	100	110.29 ± 8.52
G. 2	58.47± 4.27	52.99	63.78± 12.79	57.83	74.20± 4.33	67.30	65.48 ± 7.13
G. 3	104.13 ± 6.57	94.37	103.13 ± 5.29	93.52	114.4± 8.14	103.76	107.22 ± 6.67
Mean	90.98 ± 7.57		92.39 ± 8.48		99.62± 6.27		
L.S.D. for time (P<0.05)	14.01						
L.S.D. for groups (P<0.05)	14.01						
L.S.D. for time x groups (P<0.05)	24.26						

The initial concentration before feeding (zero time) of :
Glucose : 56±5.09 mg/dl.
Total cholesterol : 110.0±2.56 mg/dl.

3- Iron content of blood serum of rats fed on experimental diets:

By measuring the iron content of blood serum it could be observed that the iron content of group 2 was increased significantly through the feeding after 1 and 4 weeks when compared to the control. Also, the results (Table, 30) showed that there was no-significant difference between group 2 and the control after one, two and four weeks of feeding periods.

Table (30): Iron content of blood serum of rats fed on experimental diets (Mean ± S.E).

Group No.	Iron (mg/L)			
	Feeding periods (weeks)			
	1	2	4	Mean
G. 1	1.12±0.33	1.21±0.26	1.29 ± 0.22	1.21 ± 0.27
G. 2	0.61±0.18	1.15±0.19	1.27 ± 0.05	1.01 ± 0.14
G. 3	0.37±0.36	0.07±0.03	0.00 ± 0.00	0.15 ± 0.13
Mean	0.70 ± 0.29	0.81 ± 0.16	0.85 ± 0.09	
L.S.D. for time (P<0.05)	0.58			
L.S.D. for groups (P<0.05)	0.58			
L.S.D. for time x groups (P<0.05)	1.01			

The initial concentration before feeding (zero time) of iron content of mix. 3/2 was 1.05 ± 0.213 mg/L.

The iron content of blood serum of group 3 was decreased significantly during the feeding periods when compared to the control and lowered to zero after four weeks (Table, 30). The decrease of iron content in group 3 to zero after four weeks led to 20% mortality of the rats, as found by **Whittaker *et al.* (1984), Shaw (1996), Rzymowska (1996) and Deeksha-Kapur *et al.* (2002).**

4- Effect of formulated food mixture No. 3/2 as source of iron on blood picture of rats:

Total haemoglobin as well as, the counts of red blood cells (RBCs) and white blood cells (WBCs) of different experimental animals groups were determined and the results are presented in Table (31). The results showed no significant difference of haemoglubin between group 2 and the control during all feeding periods. Meanwhile, the data (Table, 31) showed no-significant difference of haemoglubin between group 3 and the control after one and two weeks of feeding periods, but there was a significant difference after four weeks.

On the other hand, the results in Table (31) showed that no significant difference of the count of RBCs between group 2 and the control, also there was no significant difference between group 3 and the control after one and two weeks but there was high significant difference after four weeks of feeding periods. In addition, there was a significant decrease of count of RBCs in group 3 after one week and four weeks of feeding periods.

Meanwhile, the results in Table (31) appeared that there was no significant difference of the count of WBCs between

Table (31): Effect of iron content on blood picture of rats feeding on formulated food mixtures (Mean ± S.E.).

Group No.	Haemoglobin (Hb)						
	Feeding periods (weeks)						
	1		2		4		Mean
	mg/dL	%	mg/dL	%	mg/dL	%	
G. 1	12.29± 0.02	100	12.31± 0.02	100	12.93± 0.31	100	12.51 ± 0.12
G. 2	12.09± 0.20	98.37	12.18± 0.45	98.94	12.80± 0.30	98.99	12.36 ± 0.32
G. 3	11.19± 0.39	91.05	11.13± 0.09	90.41	10.43± 0.020	80.66	10.92 ± 0.17
Mean	11.86 ± 0.20		11.87 ± 0.19		12.05 ± 0.21		
L.S.D. for time (P<0.05)	1.71						
L.S.D. for groups (P<0.05)	1.71						
L.S.D. for time x groups (P<0.05)	2.97						
Group No.	Red blood cells (RBCs)						
	Feeding periods (weeks)						
	1		2		4		Mean
	Volume x 10^6 mm^3	%	Volume x 10^6 mm^3	%	Volume x 10^6 mm^3	%	
G. 1	4.39± 0.01	100	4.40± 0.02	100	4.45± 0.01	100	4.41± 0.01
G. 2	4.02± 0.10	91.57	4.22± 0.12	95.91	4.36± 0.11	97.98	4.20 ± 0.11
G. 3	4.11± 0.14	93.62	4.05± 0.07	92.04	3.42± 0.08	76.85	3.86± 0.09
Mean	4.17 ± 0.08		4.22 ± 0.07		4.08 ± 0.07		
L.S.D. for time (P<0.05)	0.50						
L.S.D. for groups (P<0.05)	0.50						
L.S.D. for time x groups (P<0.05)	0.87						
Group No.	White blood cells (WBCs)						
	Feeding periods weeks)						
	1		2		4		Mean
	Volume x 103 mm3	%	Volume x 103 mm3	%	Volume x 103 mm3	%	
G. 1	7.48± 0.02	100	7.49± 0.87	100	7.49± 0.81	100	7.49 ± 0.57
G. 2	7.25± 0.16	96.92	7.27± 0.07	97.06	7.31± 0.18	97.59	7.28 ± 0.14
G. 3	8.59± 1.00	114.84	8.64± 0.17	115.35	8.76± 0.01	116.95	8.66 ± 0.39
Mean	7.77 ± 0.39		7.8 ± 0.37		7.85 ± 0.33		
L.S.D. for time (P<0.05)	1.05						
L.S.D. for groups (P<0.05)	1.05						
L.S.D. for time x groups (P<0.05)	1.82						

The initial concentration before feeding (zero time) of Haemoglobin, Red and White blood cells were 12.25+0.024 mg/dL, 4.35+0.005 x 10^6 mm^3 and 7.45+0.106 x 10^3 mm^3, respectively.

group 2 and the control, but there was considerable significant increase between group 3 and the control after one, two and four weeks of feeding periods. These results agree with those reported by **Whittaker *et al.* (1984).**

The previous results indicated the importance of using food mixture No. 3/2 to retard the effect of iron deficiency.

4.3.4. Type No. 4 (Food mixtures No. 4/1, 4/2, 4/3 and 4/4):

Formulated food mixtures as sources to compensate the deficiency of vitamin B_6, were composed from :

4/1 : 50% dried carrots + 50% lentil

4/2 : 33.3% defatted peanut + 33.3% dried carrots + 33.3% dry dates.

4/3 : 71.5% carrots + 14.5% dry dates + 14% lime .

4/4 : 47% carrots +19% lentil + 19% water + 15% lime

4.3.4.1. Chemical composition of formulated food mixtures of type No. 4:

The formulated food mixtures of type No.4 were chemically analysed and the results are presented in Table (32). The results appeared that moisture content was low for the food mixtures No. 4/1, 4/2 and 4/3 which ranged from 5.92 to 5.93, from 8.32 to 8.33 and from 10.48 to 10.51% during storage, respectively, but the moisture content of food mixture No. 4/4 was ranged from 65.14 to 65.16%. The food mixtures No. 4/1 and 4/2 in a powder form, so the low moisture content led to more effect for preserving powder, while food mixture No. 4/3 in a sheet form and mixture No.4/4 in a pulp form, so these mixtures preserved by thermal heat.

The pH values were ranged from 5.61 to 5.55, from 5.85 to 5.79, from 3.82 to 3.75 and from 4.2 to 3.8 for food mixtures No. 4/1, 4/2, 4/3 and 4/4, respectively. Also, the total acidity of food mixtures No. 4/1, 4/2, 4/3 and 4/4 were ranged from 1.09 to

1.12, from 1.01 to 1.05, from 6.22 to 6.62 and from 1.10 to 1.31%, respectively. It was observed from the data that the total acidity of food mixture No. 4/3 more than the total acidity of food mixtures No. 4/1, 4/2 and 4/4 which may be related to the lime in food mixture No. 4/3.

Reducing and total sugars as found in Table (32) were ranged from 12.68 to 12.67 and from 24.12 to 24.11% for food mixture No. 4/1, from 24.16 to 24.06 and from 36.34 to 36.33% for food mixture No. 4/2, from 28.20 to 28.14 and from 46.46 to 46.24% for food mixture No. 4/3 and from 17.82 to 17.74 and from 31.32 to 31.18% for food mixture No. 4/4, respectively. It was observed from these results that reducing and total sugars were higher in food mixtures No. 4/2 and 4/3 than food mixtures No. 4/1 and 4/4 which could be related to the high content of sugars in raw materials which composed these food mixtures as found by **Sood *et al.* (1982), Kirk and Sawyer (1991), Hasanien, Manal (1994), Ramadan (1995) and Aly (2001).**

Total free phenolic compounds were high in food mixture No. 4/3 which followed by food mixture No. 4/4 then food mixture No. 4/2 and the least food mixture No.4/1 (Table, 32), these results indicated to the high content of antioxidant in food mixture No. 4/3. Meanwhile, total free amino acids were high in food mixture No. 4/3 then food mixture No. 4/4 and lowered in food mixtures No. 4/1 and 4/2.

The crude protein contents of food mixtures No. 4/1, 4/2, 4/3 and 4/4 were ranged from 16.85 to 16.80, from 12.38 to 12.37, from 7.61 to 7.60 and from 11.63 to 11.62%, respectively. It could be showed from the results that food mixture No. 4/1

Table (32): Chemical composition of some formulated food mixtures No. 4/1, 4/2, 4/3 and 4/4 (Mean ± S.E)

Chemical composition	Mixture No. 4/1				Mixture No. 4/2			
	Storage periods (months)				Storage periods (months)			
	Zero	3	6	9	Zero	3	6	9
Moisture (%)	5.92 ± 0.01	5.92±0.01	5.92±0.002	5.93±0.001	8.32±0.01	8.32±0.01	8.32±0.01	8.33±0.003
pH value	5.61	5.60	5.58	5.55	5.85	5.85	5.80	5.79
Total acidity* (%)	1.09±0.003	1.10±0.003	1.12±0.002	1.12±0.003	1.01±0.001	1.01±0.002	1.05±0.002	1.05±0.001
Reducing sugars* (%)	12.68±0.04	12.68±0.03	12.68±0.03	12.67±0.02	24.16±0.03	24.13±0.01	24.11±0.02	24.06±0.03
Total sugars* (%)	24.12±0.02	24.12±0.02	24.11±0.02	24.11±0.02	36.34±0.04	36.34±0.03	36.34±0.02	36.33±0.03
Total free phenolic compounds*(%)	0.91±0.003	0.91±0.002	0.91±0.001	0.91±0.002	1.58±0.002	1.58±0.001	1.57±0.001	1.57±0.003
Total free amino acids* (%)	1.96±0.002	1.96±0.01	1.95±0.01	1.95±0.004	1.94±0.001	1.94±0.01	1.94±0.01	1.94±0.01
Crude protein* (%)	16.85±0.02	16.83±0.03	16.83±0.03	16.80±0.01	12.38±0.04	12.38±0.03	12.38±0.02	12.37±0.03
Crude fiber* (%)	4.85±0.02	4.85±0.01	4.85±0.02	4.85±0.01	4.92±0.01	4.91±0.02	4.91±0.01	4.91±0.02
Ash* (%)	4.22±0.001	4.22±0.003	4.22±0.003	4.22±0.002	3.44±0.002	3.44±0.002	3.44±0.003	3.44±0.001
Fat* (%)	1.71±0.001	1.71±0.003	1.71±0.002	1.70±0.001	2.87±0.01	2.87±0.01	2.86±0.01	2.86±0.01
Total carbohydrate* (%)	77.22±0.02	77.24±0.01	77.24±0.01	77.28±0.01	81.31±0.02	81.31±0.02	81.32±0.02	81.33±0.03
Total carotenidos* (as - β- carotene) (mg / 100g)	61.68±0.01	61.54±0.05	61.43±0.02	61.39±0.004	44.91±0.61	44.88±0.05	44.83±0.08	44.81±0.07

*** On dry weight.**

Table (32): Continual

Chemical composition	Mixture No. 4/3				Mixture No. 4/4			
	Storage periods (months)				Storage periods (months)			
	Zero	3	6	9	Zero	3	6	9
Moisture (%)	10.48±0.01	10.49±0.003	10.51±0.01	10.51±0.004	65.14±0.02	65.14±.0.1	65.16±0.01	65.16±0.01
pH value	3.82	3.80	3.76	3.75	4.20	4.0	3.80	3.80
Total acidity* (%)	6.22±0.02	6.29±0.02	6.57±0.01	6.62±0.02	1.10±0.001	1.17±0.01	1.31±0.01	1.31±0.002
Reducing sugars* (%)	28.20±0.03	28.17±0.02	28.15±0.03	28.14±0.02	17.82±0.03	17.80±0.01	17.76±0.02	17.74±0.03
Total sugars* (%)	46.46±0.01	46.43±0.01	46.38±0.05	46.24±0.03	31.32±0.02	31.27±0.02	31.20±0.02	31.18±0.03
Total free phenolic compounds*(%)	2.48±0.002	2.47±0.002	2.47±0.003	2.47±0.001	2.06±0.003	2.06±0.004	2.06±0.001	2.055±0.01
Total free amino acids* (%)	3.22±0.01	3.22±0.01	3.22±0.01	3.21±0.01	2.81±0.003	2.81±0.002	2.81±0.01	2.80±0.004
Crude protein* (%)	7.61±0.02	7.61±0.03	7.61±0.01	7.60±0.01	11.63±0.02	11.62±0.01	11.62±0.01	11.62±0.02
Crude fiber* (%)	7.49±0.01	7.49+0.004	7.48±0.02	7.48±0.01	6.46±0.004	6.45±0.003	6.45±0.003	6.44±0.001
Ash* (%)	4.96±0.002	4.96±0.002	4.95±0.001	4.95±0.003	4.55±0.001	4.55±0.003	4.54±0.004	4.54±0.003
Fat* (%)	1.99±0.002	1.99±0.005	1.99±0.003	1.98±0.001	2.21±0.001	2.21±0.01	2.21±0.01	2.21±0.003
Total carbohydrate* (%)	85.44±0.02	85.44±0.02	85.45±0.01	85.47±0.01	81.61±0.02	81.62±0.02	81.63±0.02	81.63±0.02
Total carotenidos* (as - β-carotene) (mg / 100g)	54.46±0.002	54.44 ± 0.003	54.40±0.02	54.39 ± 0.01	59.59 ± 0.01	59.58±0.02	59.54 ± 0.03	59.53±0.01

*** On dry weight.**

had high contents of crude protein followed by food mixtures No. 4/2, 4/3 and 4/4, which may be related to the difference of crude protein contents of raw materials which composed these food mixture as found by **El-Shamery (1988), El-Sayed, Sahar (2000) and Hamouda (2001).**

Crude fiber as shown in Table (32) was high in food mixture No.4/3 (7.49%) and food mixture No.4/4 (6.46%), and were less in food mixtures No. 4/1 and 4/2 (4.85 and 4.92%), respectively. The ash content was high in all food mixtures.

The fat content of food mixtures No. 4/1, 4/2, 4/3 and 4/4 was ranged from 1.71 to 1.70, from 2.87 to 2.86, from 1.99 to 1.98 and 2.21%, respectively, while the total carbohydrate was ranged from 77.22 to 77.28, from 81.31 to 81.33, from 85.44 to 85.47 and from 81.61 to 81.63%, respectively, as found in Table (32).

The total carotenoids of food mixtures No. 4/1, 4/2, 4/3 and 4/4 were ranged from 61.68 to 61.39, from 44.91 to 44.81, from 54.46 to 54.39 and from 59.59 to 59.53 mg/100 g, respectively. It could be observed from these results that total carotenoids were high in food mixtures No. 4/1 and 4/4 more than food mixtures No. 4/2 and 4/3, also it was showed a decrease of total carotenoids in all food mixtures during storage periods, this decrease may be related to the degradation of carotenoids. These results was in agreement with those obtained by **Mir and Nath (1993) and Zeid (1996).**

4.3.4.2. Vitamin B6 content of the formulated food mixtures No. 4/1, 4/2, 4/3 and 4/4:

The vitamin B_6 content of the formulated food mixtures No. 4/1, 4/2, 4/3 and 4/4 was determined and the results are summarized in Table (33). The results showed that the vitamin B_6 content of food mixtures No. 4/1, 4/2, 4/3 and 4/4 at zero time and after storage for 9 months was ranged from 0.60 to 0.58, from 3.64 to 3.48, from 2.36 to 2.27 and from 3.93 to 3.04 mg/100 g, respectively. The decreases of vitamin content durig storage may be related to oxidation of this vitamin as found by **Gregory (1985).**

Also, it could be observed from the results that food mixtures No. 4/2, 4/3 and 4/4 could be considered as an excellent source for vitamin B6, while food mixture No. 4/1 could be considered as a good source of vitamin B_6 when compared to the daily requirements **(Recommended Dietary Allowances, 1989).** So, these food mixtures could be used for treating the deficiency of vitamin B6.

Table (33): Vitamin content of some formulated food mixtures No. 4/1, 4/2, 4/3 and 4/4 (on dry weight basis).

Vitamin content	Mixture No. 4/1		Mixture No. 4/2		Mixture No. 4/3		Mixture No. 4/4		Recommended daily requirements	(%)			
	Storage periods (months)								Adults				
	Zero	**9**	**Zero**	**9**	**Zero**	**9**	**Zero**	**9**		Mixture No. 4/1	Mixture No. 4/1	Mixture No. 4/1	Mixture No. 4/1
Vitamin B_6 (mg/100g)	0.60	0.58	3.64	3.48	2.36	2.27	3.93	3.04	1.4-2	42.8	260	168.6	280.7

4.3.4.3.Minerals content of formulated food mixtures No. 4/1, 4/2, 4/3 and 4/4:

The minerals content of food mixtures No. 4/1, 4/2, 4/3 and 4/4 included major and trace elements were determined and the results are shown in Table (34).

The obtained data revealed that the highest potassium content was found in food mixture No. 4/3 (2108.14 mg/100 g) which followed by food mixtures No. 4/4 and 4/1 (1892.40 and 1824.75 mg/100 g, respectively) and the least concentration was observed in food mixture No.4/2 (1287.90 mg/100 g). So, the potassium content of food mixtures No. 4/1, 4/2, 4/3 and 4/4 is enough to cover about 110.59, 78.05, 127.77 and 114.69% respectively, of the recommended daily requirement of adults **(WHO, 1985).**

A clear variation was observed between the requirements and food mixtures contents of phosphorus, calcium, sodium and manganese (Table, 34).

The highest content of iron was observed in food mixtures No. 4/1 and 4/3 (7.22 and 7.09 mg/100 g, respectively) which followed by food mixture No.4/ 4 (6.86 mg/100 g) and the least concentration was found in food mixture No. 4/2 (5.12 mg/100 g), these contents of iron in food mixtures No. 4/1, 4/2, 4/3 and 4/4 is enough to cover about 60.17, 42.67, 59.08 and 57.17%, respectively, of the requirements. Meanwhile, the magnesium content of food mixtures No. 4/1, 4/2, 4/3 and 4/4 is enough to cover about 44.49, 30.12, 49.39 and 44.11%, respectively, of the requirements (Table, 34).

Table (34): Minerals content of some formulated food mixtures No. 4/1, 4/2, 4/3 and 4/4 (on dry weight basis) (Mean ± S.E.).

Minerals	Mixture No. 4/1 (mg/100g)	Mixture No. 4/2 (mg/100g)	Mixture No. 4/3 (mg/100g)	Mixture No. 4/4 (mg/100g)	Recommended daily requirements (mg)	(%)			
					adults	Mixture No. 4/1	Mixture No. 4/2	Mixture No. 4/3	Mixture No. 4/4
Potassium	1824.75 ±0.04	1287.90 ±0.02	2108.14 ±0.03	1892.40 ±0.03	1650-1875	110.59	78.05	127.77	114.69
Phosphorus	262.35 ±0.16	195.54 ±0.05	160.28 ±0.13	212.04 ±0.03	1200	21.86	16.29	13.36	17.67
Calcium	174.62 ±0.02	167.29 ±0.23	256.13 ±0.02	238.45 ±0.030	1200	14.55	13.94	21.34	19.87
Magnesium	120.13 ±0.02	81.32 ±0.02	133.36 ±0.005	119.10 ±0.06	270-400	44.49	30.12	49.39	44.11
Iron	7.22 ±0.03	5.12 ±0.22	7.09 ±0.03	6.86 ±0.03	12-15	60.17	42.67	59.08	57.17
Sodium	168.91 ±0.02	119.45 ±0.13	244.30 ±0.03	191.33 ±0.25	1600	10.56	7.46	15.27	11.96
Zinc	4.55 ±0.02	3.16 ±0.01	4.08 ±0.02	4.01 ±0.01	12-15	37.92	26.33	34.00	33.42
Manganese	1.95 ±0.01	1.39 ±0.60	1.55 ±0.01	1.56 ±0.02	350	0.56	0.39	0.44	0.44
Copper	1.52 ±0.60	1.28 ±0.01	1.73 ±0.01	1.52 ±0.03	1.7	89.41	75.29	101.76	89.41

On the other hand, zinc content of food mixtures No. 4/1, 4/2, 4/3 and 4/4 could provide the body with 37.92, 26.33, 34.00 and 33.42%, respectively, while copper content of these food mixtures could provide the body with 89.41, 75.29, 101.76 and 89.41%, respectively, when serving 100 g of these food mixtures **(RDA, 1989).**

4.3.4.4. Microbiological examination of the formulated food mixtures No. 4/1, 4/2, 4/3 and 4/4:

The log number of total viable bacterial count, molds and yeasts were determined and the results are summarized in Table (35). The results shown that the total viable bacterial count at zero time was 3.09, 2.48, 2.59 and 2.49 for food mixtures No. 4/1, 4/2, 4/3 and 4/4, respectively, while the total bacterial count after storage for 9 months was 2.58 for food mixture No. 4/1 and the count less than thirty for food mixtures No. 4/2, 4/3 and 4/4. Also, the total count of molds and yeasts were less than fifteen at zero time and after storage for 9 months for food mixtures No. 4/1, 4/2, 4/3 and 4/4.

Table (35): Log number of total viable bacterial count, molds and yeasts of some formulated food mixtures No. 4/1, 4/2, 4/3 and 4/4 (per g) (Mean ± S.E.).

Mixture No.	Total bacteria		Total molds and Yeasts	
	Storage periods (months)			
	Zero	9	Zero	9
Mixture No. 4/1	3.09±0.38	2.58	**	**
Mixture No.4/ 2	2.48	*	**	**
Mixture No.4/3	2.59	*	**	**
Mixture No. 4/4	2.49	*	**	**

* **The number less than thirty.**

** **The number less than fifteen.**

The low of total viable bacterial count, yeasts and molds related to the decrease of moisture contents of food mixtures No. 4/1, 4/2 and 4/3, while in food mixture No. 4/4 related to the effect of pasteurization of this food mixture. These results were in agreement with those reported by **Frazier (1967)** who found that during storage of the dried fruits there was a slower decrease in the number of microorganisms, more rapid at first and slower thereafter. Bacteria, yeasts and molds could not grow at available moisture below 18, 20 and (13-16%), respectively.

Also, **Abd El-Latif (1989)** reported that the dehydration decreased the total bacterial count, molds and yeasts count of orange juice.

4.3.4.5. Organolpetic evaluation of the formulated food mixtures No. 4/1, 4/2, 4/3 and 4/4:

The panel tests for food mixtures No. 4/1, 4/2, 4/3 and 4/4 were done and the results are presented in Table (36). The data appeared that the highest score of color was in food mixtures No. 4/1 and 4/2 which followed by food mixtures No. 4/3 and 4/4 and were considered palatable. Also, it could be observed from the results that there was high significant difference between food mixtures No. 4/1, 4/2 and 4/3 and food mixtures No. 4/1, 4/2 and 4/4 in zero time and after storage for 9 months, but there was no significant difference between food mixtures No. 4/3 and 4/4.

The highest score of taste was in food mixtures No. 4/2 and 4/3 which followed by food mixture No. 4/1 and the least score in food mixture No. 4/4 (Table, 36), the food mixtures No. 4/2 and 4/3 were considered palatable and food mixtures No. 4/1 and 4/4 were considered acceptable. Meanwhile, it could be showed from the data that there was high significant difference between food mixtures No. 4/1 and 4/2, 4/3, 4/4 also there was high significant difference between food mixtures No. 4/4, 4/2 and 4/4, 4/3, but there was no significant difference between food mixtures No. 4/2 and 4/3 (Table, 36).

On the other hand, the highest score of odor was in food mixture No.4/2, which followed by food mixtures No. 4/3, 4/4 and 4/1, respectively, it is odor were considered palatable. In addition, there was a significant difference between food mixture No. 4/1 and 4/2, 4/3, also between food mixture No. 4/4 and 4/2, but there was no significant difference between food mixtures

No. 4/1 and 4/4 and between food mixtures No. 4/3 and 4/4.

From previous results it was appeared that the food mixtures No. 4/2, 4/3 and 4/4 were considered a best source of vitamin B6 and these food mixtures could be using to remedy the symptoms of vitamin B6, deficiency. Also, it was showed that food mixture No. 4/3 was considered the best food mixture followed by food mixtures No. 4/4, 4/2 and 4/1, respectively, because it was rich in some ingredient such as reducing sugars, total sugars, total free phenolic compounds, total free amino acid and total charbohydrate, in addition, some minerals such as potassium, calcium, iron, magnesium, sodium, zinc and copper.

Table (36): Organoleptic evaluation of some formulated food mixtures No. 4/1, 4/2, 4/3 and 4/4 (Mean ± S.E.)

Mixture No.	Color			Taste			Odor		
	Storage periods (months)								
	Zero	9	Mean	Zero	9	Mean	Zero	9	Mean
Mixture No. 4/1	8.56 ± 0.13	8.47 ± 0.11	8.51 ± 0.12	6.02 ± 0.07	6.02 ± 0.09	6.02 ± 0.08	7.61 ± 0.08	7.48 ± 0.13	7.54 ± 0.10
Mixture No. 4/2	8.54 ± 0.07	8.31 ± 0.13	8.42 ± 0.10	7.39 ± 0.09	7.34 ± 0.07	7.36 ± 0.08	8.01 ± 0.08	8.03 ± 0.08	8.02 ± 0.08
Mixture No. 4/3	7.67 ± 0.11	7.65 ± 0.09	7.66 ± 0.10	7.21 ± 0.13	7.17 ± 0.09	7.19 ± 0.11	7.84 ± 0.09	7.61 ± 0.09	7.72 ± 0.09
Mixture No. 4/4	7.69 ± 0.09	7.57 ± 0.08	7.63 ± 0.09	5.78 ± 0.07	5.75 ± 0.09	5.76 ± 0.08	7.79 ± 0.08	7.73 ± 0.10	7.76 ± 0.09
Mean	8.11 ± 0.10	8.00 ± 0.10		6.60 ± 0.09	6.57 ± 0.08		7.81 ± 0.09	7.71 ± 0.12	
L.S.D. for time ($P < 0.05$)	0.15			0.13			0.14		
L.S.D. for mixture ($P < 0.05$)	0.21			0.19			0.19		
L.S.D. for time x mixture ($P < 0.05$)	0.29			0.26			0.27		

Palatable = more than 7.

Acceptable = 5 to 7.

Unpalatable = less than 5.

4.3.5. Type No. 5 (Food mixtures No. 5/1 and 5/2):

Formulated food mixtures as sources to compensate the deficiency of vitamin A, were composed from :

5/1 : 50% carrots + 50% apricot.

5/2 : 33.3% carrots + 33.3% apricot + 33.3% garden – rocket

4.3.5.1. Chemical composition of formulated food mixtures of type No. 5:

The chemical composition of food mixtures No. 5/1 and 5/2 were determined and the data are summarized in Table (37). The data shown that the moisture content of food mixtures No. 5/1 and 5/2 was ranged from 79.32 to 79.35 and from 78.98 to 78.99%, respectively.

The pH value of food mixtures No. 5/1 and 5/2 was ranged from 3.30 to 3.14 and from 3.90 to 4.00, respectively, while the total acidity was ranged from 4.18 to 4.38 and from 4.86 to 4.82% for food mixtures No. 5/1 and 5/2, respectively.

The increase of total acidity in food mixture No. 5/1 may be related to degradation of pectin substances or soluble pectin to galacturonic acid during storage as reported by **El-Shiaty *et al.* (1986) and El-Hamzy (1996).**

Reducing and total sugars were more in food mixture No. 5/1 than food mixture No. 5/2 which ranged from 25.06 to 24.43 and from 43.94 to 43.78% for food mixture No. 5/1, respectively, and ranged from 16.81 to 16.78 and from 35.61 to 35.60% for food mixture No.5/2, respectively (Table, 37). Also, it could be shown from the results that reducing and total

Table (37): Chemical composition of formulated food mixtures No.5/1 and 5/2 (Mean ± S.E)

Chemical composition	Mixture No. 5/1				Mixture No. 5/2			
	Storage periods (months)				Storage periods (months)			
	Zero	**3**	**6**	**9**	**Zero**	**3**	**6**	**9**
Moisture (%)	79.32 ±0.03	79.33 ±0.01	79.35 ±0.01	79.35 ±0.003	78.98 ±0.01	78.98 ±0.01	78.99 ±0.005	78.99 ±0.01
pH value	3.30	3.25	3.16	3.14	3.90	3.90	4.00	4.00
Total acidity* (%)	4.18 ±0.01	4.23 ±0.01	4.38 ±0.03	4.38 ±0.003	4.86 ±0.01	4.86 ±0.01	4.82 ±0.02	4.82 ±0.05
Reducing sugars* (%)	25.06 ±0.03	24.89 ±0.02	24.74 ±0.02	24.43 ±0.03	16.81 ±0.02	16.80 ±0.03	16.79 ±0.03	16.78 ±0.02
Total sugars* (%)	43.94 ±0.02	43.85 ±0.04	43.82 ±0.02	43.78 ±0.05	35.61 ±0.02	35.61 ±0.02	35.60 ±0.02	35.60 ±0.03
Total free phenolic compounds*(%)	2.14 ±0.02	2.13 ±0.003	2.13 ±0.01	2.11 ±0.02	1.56 ±0.01	1.50 ±0.02	1.47 ±0.02	1.45 ±0.003
Total free amino acids* (%)	2.08 ±0.01	2.08 ±0.003	2.08 ±0.003	2.07 ±0.004	2.67 ±0.01	2.67 ±0.004	2.67 ±0.01	2.66 ±0.01
Crude protein* (%)	6.53 ±0.04	6.50 ±0.03	6.50 ±0.02	6.47 ±0.03	12.31 ±0.02	12.29 ±0.03	12.28 ±0.04	12.27 ±0.03
Crude fiber* (%)	7.15 ±0.02	7.13 ±0.02	7.12 ±0.01	7.10 ±0.02	8.25 ±0.01	8.25 ±0.02	8.23 ±0.02	8.22 ±0.03
Ash* (%)	4.98 ±0.02	4.98 ±0.02	4.98 ±0.01	4.97 ±0.01	8.46 ±0.03	8.46 ±0.03	8.46 ±0.01	8.45 ±0.01
Fat* (%)	2.67 ±0.003	2.65 ±0.005	2.64 ±0.01	2.63 ±0.002	3.45 ±0.001	3.45 ±0.003	3.45 ±0.005	3.44 ±0.002
Total carbohydrate* (%)	85.82 ±0.02	85.87 ±0.02	85.88 ±0.02	85.93 ±0.02	75.78 ±0.01	75.80 ±0.02	75.81 ±0.02	75.84 ±0.01
Total carotenoids * (as β-carotene) (mg/ 100 g)	73.85± 0.01	73.80 ± 0.03	73.43 ± 0.05	73.28 ± 0.01	53.94 ± 0.01	53.76 ± 0.03	53.52 ± 0.06	53.49 ± 0.01

*** On dry weight.**

sugars were decrease during storage period which may be attributed to non enzymatic browning reaction, these results were in accordance with those obtained by **Nezam El-Din (1978), Abd El-Fadeel (1981) and Ragab (1987).**

Total free phenolic compounds of food mixture No. 5/1 were higher than food mixture No. 5/2 which ranged from 2.14 to 2.11 and from 1.56 to 1.45%, respectively. Also, it could be shown from the results (Table, 37) that the total free phenolic compounds were decrease during storage period which due to the maillard reaction as found by **Meyer (1978).**

On the other hand, it could be observed from the results that the total free amino acids were decrease during storage periods which ranged from 2.08 to 2.07 and from 2.67 to 2.66% for food mixtures No. 5/1 and 5/2, respectively, this decrease may resulted from the reaction of amino acid and sugars during non-enzymatic browning reaction as found by **Ragab (1987).**

The crude protein of food mixture No. 5/2 was more than food mixture No. 5/1 as shown in Table (37) which ranged from 6.53 to 6.47 and from 12.31 to 12.27% for food mixtures No. 5/1 and 5/2, respectively, the increase of crude protein in food mixture No. 5/2 was related to the high protein content of garden-rocket as found by **Ismail, Ghada (2002) and Abdel-Aal (2002).**

The crude fiber content of food mixtures No. 5/1 and 5/2 was ranged from 7.15 to 7.10 and from 8.25 to 8.22%, respectively. Meanwhile, it was observed from the results that the ash content of food mixtures No. 5/1 and 5/2 was ranged from 4.98 to 4.97 and from 8.46 to 8.45%, respectively, a clear increase of ash content was observed in food mixture No. 2 which related to high ash content of garden-rocket as reported by **Egyptian Nutrition Institute (1996) and Abdel-Aal (2002).**

Fat content of food mixtures No. 5/1 and 5/2 was ranged from 2.67 to 2.63 and from 3.45 to 3.44%, respectively, while the total carbohydrate content of food mixtures No. 5/1 and 5/2 were ranged from 85.82 to 85.93 and from 75.78 to 75.84%, respectively (Table, 37).

Also, it was observed from the results (Table, 37) that the percentage of total carotenoids was very high which reached to 73.85 mg/100 g in food mixture No. 5/1 at zero time and showed a low changes after storage for 9 months which was 73.28 mg/100 g. the food mixture No. 5/2 showed lower concentration at zero time (53.94 mg/100 g) and after storage for 9 months (53.49 mg/100 g) when compared to food mixture No. 5/1. The high content of total carotenoids of food mixtures No. 5/1 and 5/2 are related to the high percentage of total carotenoids of carrot and apricot as found by **Heinonen (1990), Hart and Scott (1994), El-Tanahy *et al.* (1997), Aly (2001) and Rezk (2003).**

In this concern, **Moon and Itri (1984)** reported that Beta-carotene is the most widely carotene distributed in plants and has the highest efficiency of conversion to vitamin A, which considered an essential nutrient for maintaining human and animal health. Carotenes have also been implicated as anticancer compound in numerous studies. Moreover, the provitamin A activity of some carotenoids had potentially beneficial health effect, such as antinuclear, antiaging, and antioxidant properties as well as an increased immune response could be added to there importance in the diet **(Rodriguez, Amaya, 1993).**

4.3.5.2. Vitamin A content of formulated food mixtures No. 5/1 and 5/2:

Food mixture No. 5/1 contained high concentration of vitamin A which reach to 3861.44 μg/100 g, this vitamin decreased by storage for 9 months to 3623.30 μg/100 g, but mixture No. 5/2 contained 1398.04 μg/100 g which decreased by storage for 9 months to 1254.80 μg/100 g as shown in Table (38). The high content of food mixture No. 5/1 of vitamin A is related to its high concentration of total carotenoids of apricot and carrot as found by **Hamed (1980), Heinonen (1990), Hart and Scott (1994), El-Sayed, Sahar (2000) and Aly (2001).**

In this occasion, it should be mentioned that carrot have the highest carotene content among human foods and are consumed in large quantities **(Khan *et al.*, 1975).** Much of the dietary vitamin A is derived from carotenes in vegetables and fruits. Also, α and β-carotene have 50 and 100% provitamin A activity, respectively **(Simpson, 1983).**

Table (38): Vitamin content of formulated food mixtures No. 5/1 and 5/2 (on dry weight basis).

Vitamin content	Mixture No. 5/1		Mixture No. 5/2		Recommended daily requirements	(%)	
	Storage periods (months)						
	Zero	9	Zero	9	Adults	Mixture No. 5/1	Mixture No. 5/2
Vitamin A (µg/100g)	3861.44	3623.30	1398.04	1254.80	750.0-1000	514.8	186.4

4.3.5.4. Microbiological examination of the formulated food mixtures No. 5/1 and 5/2:

The log number of total viable bacterial count, molds and yeasts were determined and the results are summarized in Table (40). The results show that the total viable bacterial count of food mixtures No. 5/1 and 5/2 was low which ranged from less than thirty to 2.52 and from less than thirty to 2.48, respectively. Also, the total count of molds and yeasts of food mixtures No. 5/1 and 5/2 were very low which were less than fifteen at zero time and after storage for 9 months, so, these food mixtures could be considered safety for using. These results are in agreement with those reported by **Abd El-latif (1989) and Radi and Arous (2000).**

Table (40): Log number of total viable bacterial count, molds and yeasts of formulated food mixtures No.5/1 and 5/2 (per g) (Mean ± S.E.).

Total count	Mixture No. 5/1		Mixture No. 5/2	
	Storage periods (months)			
	Zero	9	Zero	9
Bacteria	*	2.52	*	2.48
Molds and yeasts	**	**	**	**

* The number less than thirty.

** The number less than fifteen.

4.3.5.5. Organoleptic evaluation of the formulated food mixtures No. 5/1 and 5/2:

The panel tests for food mixtures No. 5/1 and 5/2 are summarized in Table (41) and the results showed that the color scores of food mixtures No.5/1 and 5/2 were ranged from 6.12 to 6.06 and from 6.52 and 6.51, respectively, so it were considered acceptable.

Also, it could be shown a significant difference between food mixtures No. 5/1 and 5/2 at zero time and after storage for 9 months.

The highest score of taste was in food mixture No. 5/1 followed by food mixture No. 5/2 which ranged from 6.20 to 6.08 and from 5.64 to 5.48, respectively, and were considered acceptable. There was a high significant difference between food mixtures No. 5/1 and 5/2 at zero time and after storage for 9 months.

On the other hand, it could be also observed from the results that the food mixture No. 5/1 had the highest score of odor (7.83 to 7.79), which followed by food mixture No. 5/2 (6.82 to 6.78), also there was a high significant difference between food mixtures No. 5/1 and 5/2 at zero time and after storage for 9 months.

From previous results it was appeared that food mixture No. 5/1 was very rich by vitamin A, so, food mixture No. 5/1 could be using to remady the deficiency of vitamin A, while food mixture No. 5/2 was rich in some minerals (potassium, calcium, iron and copper) than food mixture No. 5/1 so, it could be using to remady the deficiency of some minerals especially potassium and iron. Also, it observed from the results that food mixture No. 5/1 rich by reducing sugars, total sugars and total carbohydrate, while food mixture No. 5/2 rich by crude fiber, ash and total carbohydrate.

Table (41): Organoleptic evaluation of formulated food mixtures No. 5/1 and 5/2 (Mean ± S.E.)

Mixture No.	Color			Taste			Odor		
	Storage periods (months)								
	Zero	9	Mean	Zero	9	Mean	Zero	9	Mean
Mixture No. 5/1	6.12 ± 0.07	6.06 ± 0.12	6.09 ± 0.09	6.20 ± 0.09	6.08 ± 0.09	6.14 ± 0.09	7.83 ± 0.08	7.79 ± 0.10	7.81 ± 0.09
Mixture No. 5/2	6.52 ± 0.12	6.51 ± 0.13	6.51 ± 0.12	5.64 ± 0.13	5.48 ± 0.06	5.56 ± 0.10	6.82 ± 0.12	6.78 ± 0.12	6.80 ± 0.12
Mean	6.32 ± 0.09	6.28 ± 0.12		5.92 ± 0.11	5.78 ± 0.07		7.32 ± 0.10	7.28 ± 0.11	
L.S.D. for time (P < 0.05)	0.23			0.19			0.22		
L.S.D. for mixture (P < 0.05)	0.23			0.19			0.22		
L.S.D. for time x mixture (P < 0.05)	0.33			0.28			0.31		

Palatable = more than 7 .

Acceptable = 5 to 7 .

Unpalatable = less than 5 .

4.3.6. Type No. 6 (Food mixtures No. 6/1. 6/2 and 6/3):

Formulated food mixtures as source to compensate the deficiency of vitamin C, were composed from :

6/1 : 50% guava pulp + 25% orange +25% apricot + (150 ppm So_2) sodium metabisulfite.

6/2 : 50% guava pulp + 25% orange + 25% apricot

6/3 : 33.3% guava + 33.3% orange + 33.3% apricot

4.3.6.1. Chemical composition of formulated food mixtures of type No. 6

The chemical composition of food mixtures No. 6/1, 6/2 and 6/3 illustrated that:

The moisture contents of food mixtures No. 6/1, 6/2 and 6/3 during storage was ranged from 12.02 to 12.04, from 11.85 to 11.87 and from 6.87 to 6.88%, respectively. The food mixture No.6/3 contained lowest percentage of moisture content because this food mixture was dried by freeze drying to powder.

The pH values of food mixtures No. 6/1 and 6/2 were ranged from 3.96 to 3.9 and from 3.97 to 3.87, respectively and it was 4.0 in food mixture No. 6/3. It could be shown from the data (Table, 42) that the food mixture No. 6/3 did not had any changes in the pH value and still more than the other two food mixture.

Also, the total acidity ranged from 5.01 to 5.08 and from 5.0 to 5.19 % for food mixtures No. 6/1 and 6/2, respectively, Table (42): The chemical composition of formulated food mixture No. 6/1, 6/2 and 6/3 (Mean ± S.E.).

Chemical composition	Mixture No. 6/1				Mixture No. 6/2				Mixture No. 6/3			
	Storage periods (months)				Storage periods (months)				Storage periods (months)			
	Zero	3	6	9	Zero	3	6	9	Zero	3	6	9
Moisture (%)	12.02± 0.01	12.02 ±0.01	12.03 ±0.004	12.04 ±0.01	11.85 ±0.01	11.86 ±0.01	11.68 ±0.005	11.87 ±0.01	6.87 ±0.01	6.87 ±0.01	6.87 ±0.00	6.88 ±0.003
pH value	3.96	3.92	3.90	3.90	3.97	3.95	3.87	3.87	4.00	4.00	4.00	4.00
Total acidity* (%)	5.01 ±0.01	5.05 ±0.01	5.08 ±0.01	5.08 ±0.02	5.00 ±0.01	5.04 ±0.01	5.19 ±0.01	5.19 ±0.01	4.48 ±0.02	4.48 ±0.01	4.48 ±0.01	4.48 ±0.01
Reducing sugars* (%)	21.25 ±0.03	21.24 ±0.03	21.24 ±0.05	21.21 ±0.03	21.17 ±0.03	21.15 ±0.02	21.15 ±0.01	21.14 ±0.02	23.79 ±0.03	23.79 ±0.02	23.79 ±0.01	23.78 ±0.02
Total sugars* (%)	43.87 ±0.02	43.86 ±0.03	43.86 ±0.02	43.85 ±0.03	43.75 ±0.02	43.73 ±0.02	43.73 ±0.13	43.71 ±0.02	46.98 ±0.01	46.98 ±0.01	46.96 ±0.02	46.92 ±0.01
Total free phenolic compounds*(%)	1.64 ±0.02	1.64 ±0.01	1.63 ±0.02	1.63 ±0.01	1.62 ±0.01	1.62 ±0.02	1.61 ±0.01	1.61 ±0.01	2.02 ±0.02	2.02 ±0.01	2.01 ±0.01	2.00 ±0.02
Total free amino acids* (%)	1.42 ±0.01	1.42 ±0.003	1.41 ±0.01	1.41 ±0.02	1.39 ±0.01	1.39 ±0.02	1.38 ±0.01	1.38 ±0.01	1.48 ±0.01	1.48 ±0.02	1.46 ±0.01	1.45 ±0.01
Crude protein* (%)	5.30 ±0.001	5.30 ±0.002	5.30 ±0.01	5.30 ±0.01	5.26 ±0.01	5.26 ±0.01	5.25 ±0.02	5.25 ±0.01	5.46 ±0.01	5.46 ±0.01	5.46 ±0.02	5.45 ±0.003
Crude fiber* (%)	8.05 ±0.02	8.05 ±0.01	8.05 ±0.01	8.05 ±0.02	8.04 ±0.02	8.04 ±0.02	8.04 ±0.01	8.04 ±0.01	7.39 ±0.003	7.39 ±0.01	7.39 ±0.004	7.39 ±0.002
Ash* (%)	3.37 ±0.07	3.37 ±0.01	3.36 ±0.01	3.36 ±0.01	3.33 ±0.01	3.33 ±0.02	3.32 ±0.01	3.32 ±0.02	3.43 ±0.01	3.43 ±0.01	3.43 ±0.01	3.42 ±0.01
Fat* (%)	2.32 ±0.01	2.32 ±0.01	2.31 ±0.02	2.31 ±0.01	2.23 ±0.01	2.23 ±0.01	2.22 ±0.01	2.22 ±0.01	2.40 ±0.01	2.40 ±0.01	2.40 ±0.01	2.40 ±0.01
Total carbohydrate* (%)	89.01 ±0.01	89.01 ±0.01	89.03 ±0.01	89.03 ±0.01	89.18 ±0.02	89.18 ±0.02	89.21 ±0.02	89.21 ±0.01	88.71 ±0.01	88.71 ±0.01	88.71 ±0.02	88.73 ±0.01
Total carotenoids * (as β-carotene) (mg/ 100 g)	13.84 ±0.002	13.80± 0.03	13.79± 0.02	13.76± 0.01	11.66± 0.005	11.61± 0.03	11.60± 0.02	11.58± 0.01	16.81± 0.03	16.80± 0.2	16.78± 0.05	16.77± 0.05

* On dry weight

and it was 4.48% in food mixture No.6/3. The high total acidity of food mixtures, No.6/1 and 6/2 may be related to the low of pH of these mixtures.

The reducing and total sugars were relatively low in food mixtures No.6/1 and 6/2 when compared to the food mixture No.6/3 which were ranged from 21.25 to 21.21 and from 43.87 to 43.85% for food mixture No.6/1, from 21.17 to 21.14 and from 43.75 to 43.71% for food mixture No.6/2 and from 23.79 to 23.78 and from 46.98 to 46.92% for mixture No.6/3, respectively. It was observed from the results (Table, 42) that the sugars was decrease during storage which may be related to the maillard reaction as found by **Nezam El- Din (1978), Awad (1988) and Masoud (1998).**

Low changes was observed in the total free phenolic compounds, total free amino acids and crude protein during storage for food mixtures No.6/1, 6/2 and 6/3 and it was observed that food mixture No.6/3 more stability than food mixtures No.6/1 and 6/2 which may be related to the effect of freeze drying treatment as shown in Table (42).

The crude fiber of food mixtures No.6/1,6/2 and 6/3 did not changed during storage which was 8.05, 8.04 and 7.39%, respectively. Meanwhile, very low changes was observed in ash content which ranged from 3.37 to

3.36, from 3.33 to 3.32 and from 3.43 to 3.42% for food mixtures No.6/1,6/2 and 6/3, respectively.

On the other hand, results in Table (42) appeared that there was very low changes in fat content of food mixtures No.6/1 and 6/2 which ranged from 2.32 to 2.31 and from 2.23 to 2.22 %, respectively, while it stability in food mixture No.6/3 which was 2.40%.

Also, the total carbohydrate content was ranged from 89.01 to 89.03, from 89.18 to 89.21 and from 88.71 to 88.73 % for mixtures No.6/1,6/2 and 6/3, respectively. The different of the parentage between these mixtures are related to the percentage of the components which composed these mixtures.

The total caroteniods of food mixtures No. 6/1,6/2 and 6/3 were ranged from 13.84 to 13.76, from 11.66 to 11.58 and from 16.81 to 16.77 mg/100 g, respectively. It could be observed from these results that the food mixture No.6/3 had more total caroteniods than food mixtures No.6/1 and 6/2, also it observed that the using sulfur dioxid in food mixture No. 6/1 as food presenvations led to increase the concentration of total carotenoids than food mixture No.6/2 as shown in Table (42). In addition, the results appeared that there was a decrease of total carotenoids in all food mixtures during storage periods, this decrease may be related to the degradation of carotenoids as reported by **Abd El-Faddel (1981), Mir and Nath (1993) and Afifi (1995).**

4.3.6.2.Vitamin C content of formulated food mixtures No. 6/1, 6/2 and 6/3:

The vitamin C cotntent of the formulated food mixtures No. 6/1,6/2 and 6/3 were determined and the results are presented in Table (43). The results appeared that food mixture No.6/2 contain high concentration of vitamin C (Ascorbic acid) (from 117.86 to 113.2 mg/100 g) and by treating food mixture No. 6/1 by sulfur dioxide led to more preservative effects of vitamin C which ranged from 143.29 to 137.9 mg/100 g. The freeze drying of food mixture No. 6/3 contained the maximum level of vitamin C during storage (from 156.4 to 154.2 mg/100 g). The high content of vitamin C in these mixtures may be related to the high content of vitamin C in row materials which used to formulate these food mixtures, also it could be observed from the results that food mixtures No. 6/1, 6/2 and 6/3 were considered as an excellent sources for vitamin C when compared to the daily requirements **(RDA of the National Research council (NRC), 1980).**

In addition, it was observed from the results Table (43) that vitamin C was decrease after storage, this decrease may be related to oxidition of this vitamin. These results was in agreement with those reported by **Kuzniar *et al.* (1983),** who found that during storage number of factors might affect the retention of ascorbic acid in dehydrated vegetables including moisture content, temperature and length of storage. Also, **Nezam El- Din (1978) and Matuke *et al.* (1991)** reported that during 48 weeks storage ascorbic acid was decreased by 45.83 - 44.74 % for all control and treated samples of apricot or guava

Table (43): Vitamin content of formulated food mixtures No. 6/1, 6/2 and 6/3 (on dry weight)

Vitamin content	Mixture No. 6/1		Mixture No. 6/2		Mixture No. 6/3		Recommended daily requirements	(%)		
	Storage peroids (months)						Adults	Mixture No. 6/1	Mixture No. 6/2	Mixture No. 6/3
	Zero	9	Zero	9	Zero	9				
Vitamin C (mg/100g)	143.29	137.9	117.86	113.2	156.4	154.2	50-60	286.6	235.7	312.8

fruits. Additionally the decrease may be due to oxidation of ascorbic acid which acts as an inhibitor for nonenzymatic browning.

4.3.6.3. Minerals contents of formulated food mixtures No. 6/1, 6/2 and 6/3:

The minerals contents of food mixtures No.6/1, 6/2 and 6/3 were determined and the results are summarized in Table (44). The results appeared that food mixture No. 6/3 contained minerals more than the other food mixtures except potassium, manganes and copper. Food mixtures No. 6/1, 6/2 and 6/3 could be considered as a good source for some minerals such as potassium, iron, zinc and copper which were 784.8, 780.5 and 778.36 mg/100 g for potassium, 3.98, 3.95 and 4.14 mg/100 g for iron, 1.75, 1.69 and 2.11 mg/100 g for zinc and 1.09, 1.10 and 0.98 mg/100 g for copper, respectively, but these food mixtures had a low content of other minerals when compared to the daily requirements of adults **(NRC, 1980 and RDA, 1989).**

Table (44): Minerals contents of formulated food mixtures No.6/1, 6/2 and 6/3 (on dry weight) (Mean ± S.E.)

Minerals	Mixture No. 6/1 (mg/100g)	Mixture No. 6/2 (mg/100g)	Mixture No. 6/3 (mg/100g)	Recommended daily requirements (mg)	(%)		
					Mixture No. 6/1	Mixture No. 6/2	Mixture No. 6/3
Potassium	784.80 ±0.04	780.50±0.02	778.36±0.01	1650-1875	47.56	47.30	47.17
Phosphorus	119.48±0.03	118.25±0.03	128.19±0.02	1200	9.96	9.85	10.68
Calcium	138.78±0.02	139.05±0.04	155.46±0.03	1200	11.56	11.59	12.95
Magnesium	28.90±0.02	27.89±0.01	28.16±0.06	170-400	17.00	16.40	16.56
Iron	3.98±0.02	3.95±0.03	4.14±0.02	12-15	33.17	32.92	34.5
Sodium	57.70±0.02	58.02±0.01	61.25±0.01	1600	3.61	3.63	3.83
Zinc	1.75±0.01	1.69±0.02	2.11±0.03	12-15	14.58	14.08	17.58
Manganese	0.52±0.01	0.53±0.02	0.49±0.01	350	0.15	0.15	0.14
Copper	1.09±0.003	1.10±0.005	0.98±0.001	1.7	64.12	64.70	57.65

4.3.6.4. Microbiological examination of the formulated food mixtures No. 6/1, 6/2 and 6/3 :

The log number of total viable bacterial count, molds and yeasts were found in Table (45) and the data appeared that the total viable bacterial count was low at zero time and after storage for 9 months which were 2.52 to 2.67, 2.49 to 2.53 and less than thirty to 2.42 for food mixtures No. 6/1, 6/2 and 6/3, respectively. Also, the total count of molds and yeasts were very low at zero time and after storage for 9 months for all food mixtures (Table,45).

Table (45): Log number of total viable bacterial count, molds and yeasts of formulated food mixtures No. 6/1 , 6/2 and 6/3 (per g) (Mean ± S.E.)

Total count	Mixture No. 6/1		Mixture No. 6/2		Mixture No. 6/3	
	Storage periods (months)					
	Zero	9	Zero	9	Zero	9
Bacteria	2.52	2.67	2.49	2.53	*	2.42
Molds and yeasts	**	**	**	**	**	**

* **The number less than thirty.**

** **The number less than fifteen.**

The low number of total viable bacterial count and molds and yeasts due to the decrease of moisture contents of these food mixtures and these results indicate to the health and the safety of these food mixtures. These results were in agreement with those reported by **Nezam El- Din (1978)** who found that dried apricot sheet had a very few total count (10-100 cell / g.) **ICMSF (1980)** reported that dehydration prevents the microbial growth. Drying should reduce the water activity of fruits to a level of 0.6-0.7 which spoil organisms and do not enable them to grow. Therefore, the drying process must be rapidly performed to preclude significant growth of spoilage forms before water activity is reduced to safe scale level pathogenic microorganisms cannot grow at the pH of most fruits. Also, **Abd El- Latif (1989)** found that the total bacterial count, molds and yeasts count were decreased in the dried orange powder after storage for 6 month's at room temperature. In addition, **El- Said (1992)** showed that the total bacterial count, molds and yeasts count not increase during storage of dehydrated guava powder at room temperature for 6 months.

4.3.6.5. Organoleptic evaluation of the formulated food mixtures No. 6/1, 6/2 and 6/3:

The panel tests for food mixtures No. 6/1, 6/2 and 6/3 as found in table (46) show that the highest score of color was in food mixture No.6/3 followed by food mixture No.6/1 and then food mixture No.6/2, and were considered palatable. Also, it could be observed from the results that there was high significant difference between food mixture No.6/3 and food mixtures No.6/1 and 6/2 at zero time and after storage for 9 months. There was no significant difference of color score in all food mixtures during storage periods.

Table (46): Organoleptic evaluation scores of formulated food mixtures No. 6/1, 6/2 and 6/3 (Mean ± S.E.).

Mixture No.	Color			Taste			Odor		
	Storage periods (months)								
	Zero	**9**	**Mean**	**Zero**	**9**	**Mean**	**Zero**	**9**	**Mean**
Mixture No. 6/1	8.63±0.07	8.53±0.07	8.58±0.07	7.82±0.10	7.76±0.16	7.79±0.13	8.27±0.13	8.27±0.13	8.27±0.13
Mixture No. 6/2	8.43±0.12	8.41±0.13	8.42±0.12	8.02±0.09	7.92±0.10	7.97±0.09	7.84±0.12	7.81±0.08	7.82±0.10
Mixture No. 6/3	9.09±0.09	9.07±0.10	9.08±0.09	9.04±0.07	9.03±0.06	9.03±0.06	8.39±0.13	8.38±0.09	8.38±0.11
Mean	8.72 ±0.09	8.67±0.10		8.29±0.09	8.24±0.11		8.17±0.13	8.15±0.10	
L.S.D. for time ($P < 0.05$)	0.16			0.17			0.19		
L.S.D. for mixture ($P < 0.05$)	0.20			0.20			0.23		
L.S.D. for time x mixture ($P < 0.05$)	0.28			0.29			0.33		

Palatable = more than 7 .

Acceptable = 5 to 7 .

Unpalatable = less than 5 .

Also, the highest score of taste was in food mixture No. 6/3 followed by food mixture No.6/2 and then food mixture No.6/1 as shown in table (46), and were considered palatable. There was high significant difference between food mixture No.6/3 and food mixtures No.6/1 and 6/2 during storage. There was no significant difference of taste score in all food mixtures during storage periods.

On the other hand, the highest score of odor was in food mixture No.6/3 followed by food mixture No.6/1 and then food mixture No.6/2,and were considered palatable. There was high significant difference between food mixtures No.6/3 and 6/2, but there was no significant difference between food mixtures No. 6/3 and 6/1 at zero time and after storage for 9 months. In addition, there was a significant difference between food mixtures No.6/1 and 6/2 at zero time and after storage for 9 months. There was no significant difference of odor score in all food mixtures during storage periods (Table, 46).

From previous results it was observed that food mixture No. 6/3 had more quality than food mixtures No. 6/1 and 6/2. The food mixtures No.6/1, 6/2 and 6/3 were very rich in vitamin C (ascorbic acid), so, it could be using to remove the symptoms of vitamin C deficiency. Also, food mixtures No. 6/1, 6/2 and 6/3 were considered as a good source for reducing sugars, total sugars, total free phenolic compounds, crude fiber and total catbohydrate, in addition, some minerals such as potassium, iron, zinc and copper.