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# INNOVATED WEANING FOODS. II-NUTRITIVE VALUE AND QUALITY ATTRIBUTES

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## ABSTRACT

Eight weaning food blends were innovated from treated cereals and legumes based on 70:30%, respectively. Fruits and vegetables were also added in different percentages. Protein, fat, ash, fiber, carbohydrates and calorific value content of the blends ranged from 17.4 to 22.2%, 0.48 to 2.74%, 1.03 to 2.35%, 1.26 to 2.015, 67.55 to 74.86% and 350.9 to 375.4 kcal, respectively. The blends were rich in minerals; P, K, Ca, Mg, Fe and vitamin A and thiamin. The essential amino acids improved except the tryptophan which has been detected as a limiting amino acid. Biological evaluation of weaning foods indicated high nutritive values for all prepared blends. The superior blends indicating high values of net protein utilization, digestibility coefficient and biological value were blends (1), (5) and (8) which contain chickpeas. Organolyptic evaluations were acceptable. Costs were cheaper than the commercially processed foods as Riri and Cerelac which were nearly five to eight times less in cost.

***Key words**: amino acids, biological value, costs, minerals, nutritive value, vitamins, weaning foods.*

## 1. INTRODUCTION

Weaning foods have been developed to complement the nutritional requirements of children aged 6-24 months. This food group should be organoleptically acceptable, easy to swallow, and free from anti-nutritional factors. In this respect, Hegazy *et al.,* (1989) prepared seven baby food formulas constituted of chickpeas, lentils, whole wheat flour, skim milk, sugar, rice, soybean and simolina. Chemical and biological bioassay revealed that these mixtures were rich sources in protein which ranged between 17.6 to 18.4% with a high level of essential amino acids. Massoud (1992) studied the chemical and technological properties of some cereal and legume blends for preparing balanced baby foods. Soybean, lupine, lentil, rice, wheat and corn flour were used for formulation. Legumes were a good source of protein and the biological values (BV) were increased due to the level of legumes in the blends. Hamza (1997) reported that the most suitable nutritionally balanced weaning foods were prepared from wheat, corn, chickpeas, mung beans and skimmed milk powder which are available in the Egyptian local market.

The aim of the present investigation is to prepare weaning foods characterized with high nutritive values and low cost by using local raw materials, *i.e.* cereals, legumes, fruits and vegetables free from anti-nutritional factors (ANF).

## 2. MATERIALS AND METHODS

The raw materials used for the preparation of different weaning foods were; cereals [wheat (*Triticum aestivum*, L.) Variety Sakha 69, white maize (*Zea maize*, L.) Variety Giza 2 and millid rice (*Oryza sativa*, L.) commerial]; legumes [ faba beans *(Vicia faba*, L.) Variety Giza Blanka, lentils ( *Lens culinarsi,* L) Variety Giza 9, chickpeas (*Cicer arietinum*, L.) Variety Giza 531, cowpeas ( *Vigna unguiculata*, L.) Variety Cream 7 and white beans (*Phaseolus vulgaris*, L.) Variety Giza 6], fruits [apples (*Malus pumila,* L.) Golden Variety and banana (*Musa nana*, L.) Maghrabi Variety] and vegetables [carrots (*Daucus carota*, L.) and potatoes (*Salanum tubersonium*, L.) commerial]. The previous cereal and legumes were obtained from Field Crops Research Institute, Agricultural Research Center, Giza, Egypt. Whereas fruits, vegetables and milled rice were purchased from the local market.

After removal of the anti-nutritional factors from the raw materials by treatments ( Ismail *et al.*, 2000 ), weaning blends were prepared as shown in Table (1). Chemical composition of the blends, *i.e.*, moisture, protein, fat, crude fiber and ash content were determined according to the methods outlined in A.O.A.C. ( 1990 ) while total carbohydrates were calculated by difference. Amino acid determination was carried out using HPLC according to the method described by Millipore Co-operative (1987), while tryptophan was determined according to the method described by Hernandez and Bates (1969). Chemical scores of the amino acids were determined according to FAO/ WHO/ UNU (1989). Formulated baby foods were calculated according to Hawk *et al.*, (1949). Minerals including K, Ca, Mg, Fe and Zn were determined according to the method of Gorsach (1959) using Pye Unicam Sp 1900 Atomic absorption Spectrophotometer, while total phosphorus was determined using the common colorimetric method outlined in A.O.A.C. (1990). Vitamin A (as carotenoids) and vitamin B1(thiamin) were determined according to the method described by Wettesten (1957) and Pearson (1970), respectively. Consistency and shear stress of the blends were measured according to the method described by Wagner and Miers (1967). Viscometer model LDV programmable rheometer was used at room temperature by using SC4-25 spindle at different rotation speeds, *i.e.*, 50, 100, 150 and 200 rpm. Weaning food formulas were subjected to biological evaluation by feeding the experimental rats. The biological evaluations included net protein utilization, digestibility coefficient and biological value which were determined according to methods described by FAO/ WHO/ UNU (1989), while net dietary protein value was determined according to the method described by Robinson (1987). Organoleptic evaluation of the different formulated weaning foods was sensory evaluated by ten panelist for color, taste, odor, texture and appearance according to Notter *et al.*, (1959). The biological and organoleptic evaluations were statistically analyzed according to the methods described by Gomez and Gomez (1984). Cost of every formulated weaning food under study was calculated according to Harper *et al.*, (1983).

## 3. RESULTS AND DISCUSSION

The formulated weaning foods presented in Table (1) were chemically analyzed for protein, fat, ash, fiber and total carbohydrates and the results are presented in Table (2). The protein content of the different blends ranged between 17.40-22.2%, fat 0.48-2.74, ash 1.03-2.36, fiber 1.26-2.01 and carbohydrates 71.84-79.83%, meanwhile the calculated energy ranged from 389.70 to 400.34 Kcal /100g sample. In this respect, Egyptian Organization for Standardization and Quality Control (1998) recommended that the protein content of weaning foods should be not less than 15%. On the other hand, total energy of the blends should meet the recommended daily allowance of the recently weaning children.

**Table (1): Composition of weaning food blends (g / 100g $_{dry\ wt.}$).**

| Ingredients* | Blends | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Wheat | 70 | - | - | 40 | 30 | - | 25 | 30 |
| Maize | - | 70 | - | 23 | - | 43 | 13 | 13 |
| Rice | - | - | 70 | - | 33 | 20 | 25 | 18 |
| Faba beans | - | 15 | 30 | 15 | - | - | - | - |
| Lentils | 15 | - | - | - | - | 7 | 12 | - |
| Chickpeas | 15 | - | - | - | 10 | - | - | 12 |
| Cowpeas | - | - | - | 12 | 17 | 20 | - | - |
| White beans | - | 15 | - | - | - | - | 15 | 15 |
| Apples | - | - | - | 5 | - | - | - | 5 |
| Banana | - | - | - | 5 | - | - | - | - |
| Carrots | - | - | - | - | 10 | - | 5 | 5 |
| Potato | - | - | - | - | - | 10 | 5 | - |

*After removal of anti-nutritional factors.

**Table (2): Chemical composition (g/100g $_{dry\ wt.}$) and total energy values (kcal / 100g) of weaning food blends.**

| Blends | Moisture | Protein | Fat | Ash | Fiber | Carboh-ydrates* | Total** energy Kcal/100 g |
|---|---|---|---|---|---|---|---|
| (1) | 4.00 | 22.20 | 2.57 | 1.38 | 2.01 | 71.84 | 399.30 |
| (2) | 6.34 | 21.74 | 2.74 | 1.73 | 1.61 | 72.18 | 400.34 |
| (3) | 4.63 | 17.40 | 0.48 | 1.03 | 1.26 | 79.83 | 393.24 |
| (4) | 5.73 | 19.35 | 2.13 | 2.10 | 1.50 | 74.93 | 396.30 |
| (5) | 3.80 | 18.90 | 0.53 | 1.48 | 1.74 | 77.62 | 390.85 |
| (6) | 6.20 | 19.87 | 1.30 | 1.37 | 1.90 | 75.56 | 393.42 |
| (7) | 4.15 | 21.05 | 0.67 | 1.60 | 1.73 | 74.96 | 390.07 |
| (8) | 4.40 | 18.32 | 1.26 | 2.36 | 1.80 | 76.27 | 389.70 |

- Carbohydrates calculated by differences,** Total energy = % protein x 4 + % total carbohydrate x 4 + % total fat x 9.

Results in Table (3) show estimated chemical score of the amino acid profile of the produced weaning food blends. It can be seen that the chemical score of the majority of the amino acids located in different blends are relatively high, with the exception of tryptophan which is considered a limiting amino acid. The other limiting amino acids are the sulpher- containing amino acids.

Minerals and vitamin (A and B1) contents of the different weaning food blends are shown in Table (4). Results revealed that blend (5) was characterized by the highest content of macro- elements while blend (3) showed the lowest ones. Concerning the micro-elements, iron resulted in the highest amount (3.99mg /100g) for blend (5) while its lowest amount (1.66 mg / 100g) was found in blend (2). The highest level of zinc content (1.91mg / 100g) was found in blend (1) while the lowest content (0.38 mg /100g) resulted in blend (3). Concerning vitamins, vitamin A showed its maximum value (10.85 and 10.37 mg / 100g) for blends (8) and (5), respectively while a moderate amounts of it was found for blends (7) and (4) being 7.54 and 6.27mg / 100g, respectively. Other blends contained vitamin A ranging between 0.44 and 3.73 mg / 100g sample. Thiamin content ranging from 0.17 to 0.21 mg /100g for all blends except that of blend (1) which contained about double fold as that of other formulas. In view of the formulated weaning foods, it could be concluded that the presence of carrot increased vitamin A content. Also cereal and legume blends beside the fruits and vegetables were considered rich sources of minerals either macro or micro. In this concept, Gahlawat and Sehgal (1993) formulated four weaning foods using locally available cereals and pulses such as wheat, barley, green gram and jaggery. They mixed the cereals and pulses in the ratio of 7:3. Moreover, roasting and malting were the processing techniques used in developing weaning foods which resulted in a significant increase in minerals such as Ca, Fe, P, Zn and Cu. In addition, Mansour *et al.*, (1993) reported that during heat treatments of the meals increasing and decreasing of some minerals were found. They mentioned also that germination increased Na, P and Zn but decreased the other minerals.

The data presented in Table (5) show the consistency and shear stress of the formulated blends. The data revealed that the highest consistency values (153.6 and 96 C.P) resulted for blend (5) followed by blend (7), respectively. Other blends showed consistency ranging from 38.5 to 78.0 CP at 50 rpm. Increasing speed resulted in decreasing consistency. On the other hand, shear stress resulted in highest value for the formula (5) followed by (7) in values of 16.9 and 10.6 (D / Cm2), respectively at 50 rpm. Increasing speed resulted in increasing shear stress. The results of consistency and shear stress revealed a negative and positive consolation, respectively with speed rotation for all formulated blends. It could be concluded that the presence of fruits and vegetables in the formula increase the consistency value. In this respect, Faridi and Favbion (1986) reported that the fluid components, *i.e.*, starch, gluten, pentosans, etc. ( in the base of a batter)

**Table (3): Chemical score estimated for weaning food protein.**

| Amino acid | FAO/WHO/UNU (1989patern** | Formulated baby food blends | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Isoleucin | 46 | 84.58 | 86.47 | 88.59 | 81.90 | 89.90 | 87.60 | 89.70 | 94.30 |
| Lucine | 93 | 77.40 | 98.90 | 77.23 | 84.20 | 96.60 | 100.2 | 88.00 | 103.00 |
| Lysine | 66 | 74.66 | 76.86 | 82.99 | 69.00 | 86.10 | 75.63 | 79.41 | 73.70 |
| Methionine+ Cystin | 42 | 77.75 | 73.20 | 87.30 | 90.70 | 106.1 | 58.8* | 68.80 | 103.10 |
| Phenylalanin + Tyrosine | 72 | 125.9 | 118.3 | 119.4 | 112.8 | 84.84 | 127.4 | 120.0 | 120.30 |
| Threonine | 43 | 114.8 | 97.31 | 81.00 | 77.20 | 85.90 | 86.12 | 84.20 | 73.29 |
| Valine | 55 | 86.21 | 91.07 | 95.92 | 85.14 | 91.50 | 96.50 | 101.0 | 87.60 |
| Histedine | 26 | 83.03 | 99.12 | 88.50 | 82.20 | 94.99 | 95.50 | 115.3 | 89.70 |
| Tryptophan | 17 | 57.9* | 51.5* | 70.8* | 61.7* | 73.4* | 65.80 | 67.3* | 68.80* |
| Limiting A.A | - | Tryp. | Tryp. | Tryp. | Tryp. | Tryp. | T.S. | Tryp.+ T.S | Tryp |

** mg / g protein

**T.S.** means total sulphure amino acids.

**Table (4): Minerals and vitamins content of the formulated weaning food blends (mg / 100g $_{dry\ wt.}$)**

| Blends | Macro-elements | | | | Micro-elements | | Vitamins | |
|---|---|---|---|---|---|---|---|---|
| | P | K | Ca | Mg | Fe | Zn | A | $B_1$ |
| (1) | 200 | 483.2 | 62.2 | 58.8 | 2.48 | 1.91 | 3.73 | 0.50 |
| (2) | 238 | 514.7 | 75.1 | 81.6 | 1.66 | 1.29 | 0.56 | 0.20 |
| (3) | 113 | 336.1 | 62.2 | 22.2 | 2.33 | 0.38 | 1.93 | 0.18 |
| (4) | 118 | 451.7 | 72.5 | 71.6 | 3.63 | 1.78 | 6.27 | 0.21 |
| (5) | 238 | 546.2 | 75.1 | 108.0 | 3.99 | 1.66 | 10.37 | 0.18 |
| (6) | 188 | 462.0 | 41.5 | 78.90 | 2.56 | 1.36 | 0.44 | 0.17 |
| (7) | 200 | 525.2 | 59.6 | 90.80 | 1.98 | 1.36 | 7.54 | 0.20 |
| (8) | 213 | 535.7 | 62.2 | 91.70 | 2.91 | 1.36 | 10.85 | 0.18 |

Vitamin A as caroten.

Vitamin $B_1$ = thiamin.

play a significant role in viscosity value.

**Table (5): Consistency* as well as shear stress of weaning blends.**

| Consistency and shear stress | Weaning food formula. | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Consistency at | | | | | | | | |
| 50 r.p.m | 48.0 | 48.8 | 38.5 | 76.8 | 153.6 | 78.0 | 96.0 | 76.8 |
| 100 r.p.m | 35.2 | 38.8 | 28.8 | 67.2 | 115.2 | 67.2 | 76.8 | 76.8 |
| 150 r.p.m | 33.6 | 38.4 | 19.2 | 57.6 | 86.40 | 51.2 | 54.4 | 57.8 |
| 200 r.p.m | 28.8 | 33.6 | 16.8 | 40.8 | 67.20 | 36.0 | 48.0 | 45.6 |
| Shear stress ** | | | | | | | | |
| 50 r.p.m | 5.3 | 3.17 | 0.0 | 8.4 | 16.9 | 5.28 | 10.0 | 8.4 |
| 100 r.p.m | 7.4 | 8.45 | 6.3 | 14.8 | 25.3 | 14.8 | 16.9 | 16.9 |
| 150 r.p.m | 11.6 | 12.7 | 6.3 | 17.9 | 28.5 | 15.8 | 17.9 | 19.0 |
| 200 r.p.m | 12.7 | 14.8 | 7.4 | 19.0 | 29.6 | 16.9 | 21.1 | 20.1 |

* Consistency of different blends was determined at ambient temperature at different speed rotation in (CP).

** Shear stress was determined as $D / CM^2$

**Table (6): Organoleptic evaluation of weaning food blends.**

| Blends | Colour (10) | Taste (10) | Odor (10) | Texture (10) | Appearance (10) | Overall Average score |
|---|---|---|---|---|---|---|
| (1) | 5.733C | 5.333C | 6.267A | 6.267A | 5.667C | 5.58C |
| (2) | 6.600B | 5.067C | 5.667A | 6.467A | 6.133BC | 5.98B |
| (3) | 6.467B | 5.400C | 6.600A | 6.267A | 6.200BC | 6.18B |
| (4) | 5.533C | 5.400C | 5.667A | 6.600A | 5.733C | 5.79CB |
| (5) | 8.267A | 7.667A | 6.533A | 7.400A | 8.067A | 7.58A |
| (6) | 6.267B | 5.600C | 5.933A | 6.600A | 6.467B | 6.17B |
| (7) | 7.067A | 6.000B | 6.400A | 6.733A | 7.000B | 6.30B |
| (8) | 7.667A | 7.133A | 6.933A | 7.133A | 7.400A | 7.23A |
| L.S.D.0.05 | 0.897 | 0.918 | N.S.* | N.S.* | 0.907 | 0.905 |

- N. S. means non-significant.

The formulated weaning food blends were organoleptically evaluated and the results are presented in Table (6). Odor and texture resulted in non-significant changes between all blends. Meanwhile, color, taste, appearance and average score showed significant changes with L.S.D. at 0.05 of 0.897, 0.918, 0.907 and 0.905, respectively. It could be concluded that the variation of score between blends depends upon the ingredients of the formula which reflect the highest mean score of 7.58 and 7.23 for blends (5) and (8), respectively and lowest one being 5.58 for blend (1).

Net protein utilization (NPU), digestibility coefficient (DC) and biological value (BV) of the experimental animals fed on the tested weaning formulas (either processed or raw) compared with casein diet were determined as an indicator for the produced weaning food formulas and the results are presented in Table (7). The data revealed that NPU of all blends either processed or raw showed highly significant decrease except that of processed blend (1) which showed non-significant changes compared with casein diet. Digestibility coefficient (DC) showed highly significant decrease of all treatments ( processed or raw ) compared with casein diet. The biological value (BV) resulted in highly significant decrease when the animals fed on raw blends except that of blends (5) and (8) which showed non significant changes compared with casein diet. On the other hand, the processed blends showed BV of highly significant decrease due to feeding on formula (2), significant increase due to feeding on formula (1), (4), and (8) and non-significant changes for the other formulas compared with casein diet. The highly significant increase of the NPU, DC and BV of the processed formulas than that of raw ones may be due to the removal of the anti-nutritional factors. The obtained results are in the line with the findings of Eggum *et al.* (1993) who found that true digestibility was 99-100%, biological value (BV) 73-80% and net protein utilization (NPU) 70-74% when animals were fed on cooked rice while it was 90-97%, 64-68% and 64-68% for TD, BV and NPU when animals fed on untreated rice.

According to the price of each ingredient in the local market, the cost of the production was computed including also transportation and preparation. The composition and cost of the developed blends compared with the price of commercial products such as Riri and Cerelac are presented in Table (8). The data revealed that the costs of commercial products were nearly 5-8 times costs of more than the developed weaning blends. In this respect, Dahiya and Kapoor (1993) produced four supplements which were developed from local available expensive food items using home- processing methods such as roasting and malting.

**Table (7): Biological evaluation of the formulated weaning food blends.**

| Experimental diet | N.P.U (1) | DC (2) | BV (3) |
|---|---|---|---|
| Casein diet | 80.0 A | 96.03 A | 83.30 B |
| Treated: | | | |
| (1) | 79.26 A | 87.88 B | 90.31 A |
| (2) | 48.06 F | 73.18 BC | 66.82 C |
| (3) | 68.66 C | 78.25 CB | 87.86 A |
| (4) | 69.56 C | 75.67 CB | 92.41 A |
| (5) | 74.76 B | 89.25 B | 83.46 B |
| (6) | 69.08 C | 79.40 CB | 86.93 A |
| (7) | 50.69 E | 67.90 D | 83.39 B |
| (8) | 65.48 DC | 72.65 CB | 91.06 A |
| Mean (x) | 65.69 DC | 78.02 CB | 85.28 A |
| Raw: | | | |
| (1) | 46.99 F | 66.41 C | 70.61 C |
| (2) | 25.42 I | 63.60 D | 40.96 F |
| (3) | 35.22 H | 62.56 D | 61.73 D |
| (4) | 48.50 F | 66.64 D | 72.23 C |
| (5) | 55.51 E | 65.79 D | 85.64 A |
| (6) | 43.44 F | 70.74 B | 63.30 D |
| (7) | 27.50 I | 52.32 F | 54.70 ED |
| (8) | 52.99 E | 60.49 E | 88.20 A |
| Mean (x) | 41.94 G | 63.49 C | 67.12 D |
| L.S.D. at o.o5 for: | | | |
| Treatments: | 4.528 | 4.598 | 6.110 |
| Treated x Raw: | N.S. | N.S. | N.S. |

(1) N.P.U means net protein utilization. (2) D.C means digestibility coefficient.
(3) BV means biological value.
*L. S. D. means least significant differences
**N. S. means non significant.

**Table (8):Cost of weaning food blends (100g) compared with commercial products (in P.T.).**

| Blends | Costs in P.T. | | | | |
|---|---|---|---|---|---|
| | Raw materials | Processing | Packaging | Profit | Total |
| 1 | 17.10 | 5.73 | 4.28 | 4.28 | 31.39 |
| 2 | 12.90 | 4.32 | 3.23 | 3.23 | 23.68 |
| 3 | 12.95 | 4.34 | 3.24 | 3.24 | 23.77 |
| 4 | 13.33 | 4.47 | 3.33 | 3.33 | 24.46 |
| 5 | 17.68 | 5.92 | 4.24 | 4.42 | 32.44 |
| 6 | 17.21 | 5.77 | 4.30 | 4.30 | 31.58 |
| 7 | 15.59 | 5.22 | 3.90 | 3.90 | 28.61 |
| 8 | 16.30 | 5.46 | 4.08 | 4.-8 | 29.92 |
| Commercial baby food:- | | | | | |
| Cerelac: | 248.0 | | | | |
| Cerelac+fruits: | 291.0 | | | | |
| Riri: | 239.3 | | | | |
| Riri+ carrots: | 416.6 | | | | |

In conclusion, treatments of raw materials *i.e.*, cereals, legumes, fruits and vegetables of local origin could be used in formulation of nutritive, acceptable and cheap weaning foods.

## 5. REFERENCES


A.O.A.C. (1990). Official Methods of Analysis of the Association of Official Analytical Chemists, 15th ed. Washington DC.

Dahiya S. and Kapoor A.C. (1993). Nutrition evaluation of home-processed weaning food based on low cost locally available foods. Food Chem. 48:179-

Eggum B.O., Perez C.M., Julinana B.O. and Acedo E.F. (1993). The resistant starch undigestable energy and undigestable protein contents of raw and cooked milled rice. J. Cereal Sci, 18: 159-

Egyptian Organization for Standardization and Quality Control (1998). Cereal- based baby foods. Egypt.

FAO/ WHO/ UNU (1989). Energy and protein requirements. Report of Joined FAO/ WHO/ UNU, Expert consolation world health organization technical report, ser. 724, WHO, Geneva.

Faridi H. and Favbion J.M. (1986). Fundamintals of dough rheology. The American Association of Cereal Chem. Inc. St Paul, Minn. USA.

Gahlawat P. and Sehgal S.(1993). The influence of roasting and malting on the total and extractable mineral contents of human weaning. Mixtures prepared from India raw materials. Food Chem. 46(3):253-

Gomez K.A. and Gomez A.A.(1984). Statistical procedure for agricultural research. John Wiley and Sons. Inc. USA.

Gorsach T.T. (1959). Radiochemical investigation on the recovery for analysis of trace elements in organic and biochemical materials. The Analyst. 84:135

Hamza Assa A.B. (1997). Chemical and nutritional characteristics of weaning foods prepared from cereal and legumes. Ph.D. Thesis. Fac. Agric. Cairo Univ.

Harper J.M., Hegazi E.M., Gabrial G.N. and Morsi M.K. (1983). Tannin content and digestability of soybean. Agron. J. 62:633-

Hawk P.D.,Oser B.L. and Summerson W.H.(1949). Practical Physiological Chemistry. J. Nutr. 12:962-

Hegazi S.M., Hussein M.M. and Bressani R.(1989). Nutritional quality of low cost food supplements for infant feeding. Egypt J. Food Sci. 17 (1-2):1.

Hernandez H.and Bates L. S.(1969). A modified method for rapid tryptophan analysis of maize. Res. Bull. No 13. pp7 Cimmyt, Mixico.

Ismail Ferial A., Basyony A.E. and Farag Manar M.A. (2000). Innovated weaning foods. I-Chemical composition and removal of anti-nutritional factors. Bull. Fac. Agric., Cairo, Univ.Vol. (51): 447-460.

Mansour E.H., Lugasi A., Goal O., Barna E., Dworschak, E. and Gergerly, A. (1993): Effect of processing on the anti-nutritive factors.and nutritive value of rape seed products. Food Chem. 47:247-

Massoud O.R. (1992). Chemical and technological studies on some vegetable protein blends. M. Sc. Thesis, Fac. Agric. Menoufia Univ.

Millipore Co-operative (1987). Liquid chromotographic analysis of amino acids in foods using a modification of the PICO-TAG method

Notter G.K., Tayler D.H. and Dawnems N.J. (1959). Orange juice powder, factors affecting storage stability. Food Techn. 13:113.

Pearson D. (1970). The chemical analysis of foods: National College of Food Techn. Univ. of Reading. Wehbridge, Servery T. and A. Chirchill. Ph.D. Thesis.

Robinson D.S. (1987). The nutritional value of protein. In: Food Biochemistry and Nutritional value. Chapter 3, pp 136. 4th ed. John Wiley and Sons. Inc. New York, USA.

Wagner G.R. and Miers J.C.C.(1967). Consistency of tomato product. I-The effect of tomato enzyme inhibition by additions. J. Food Techn., 21:290-

Wettesten D.V.(1957). Chlorophyl II-Letal und der supmkopische from-wechsee der plastiden-Exper. Cell Res. 12: 427.[ C.F.- M.Sc. Thesis 1978. Home Economics Dep., Faculty of Agriculture, Cairo University.

## أغذية الفطام المحدثة: 2- القيمة الغذائية و عناصر الجودة

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### ملخص

تم تحديث ثمان خلطات أغذية فطام و كان محتواها من البروتينات، الدهون، العناصر المعدنية، الألياف و السعرات الحرارية الآتي 22.2 % إلى 17.4%, 2.74% إلى .0.48%. 2.35%إلى1.03%, 2.01% إلى 1.26%, 74.86% إلى 67.55 % و 375.4 إلى 350.9 كيلو كالورى/ 100 جرام على التوالي. كانت هذه الأغذية غنية بالعناصر الغذائية المختلفة مثل الكالسيوم, الفوسفور، البوتاسيوم، الماغنسيوم، الحديد ، الزنك و الفيتامينات مثل فيتامين أ و ب1 فيما عدا الخلطة 2 فكانت فقيرة في الحديد و المكونة من ذرة و فول بلدي و فاصوليا بيضاء ؛ كذلك الخلطة (3) المكونة من الأرز و الفول البلدي فقيرة في الزنك . تحسنت الأحماض الأمينية الأساسية فيما عدا التربتوفان كان محدداً في معظم الخلطات عدا الخلطة (6) المكونة من ذرة و أرز و عدس و لوبيا وبطاطس. كانت الأحماض الأمينية الكبريتية هي العامل المحدد . تنوعت لزوجة الخلطات وذلك لتنوع المكونات الغذائية الداخلة في تركيبها. كانت الاختبارات البيولوجية التي أجريت على الخلطات المعاملة مثل صافى البروتين المستفاد, معامل الهضم, القيمة الحيوية و صافى البروتين الحيوي الغذائي كانت 79.25 إلى 48.06 , 89.25 إلى 67.9, 92.4 إلى 66.8 و 8.07 إلي 11.53 مقارنة بكل من الخلطات الخام التي كانت قيمها 46.98 إلى 25.4, 65.76 إلى 52.32, 72.23 إلي 40.95 و 6.6 إلى 8.69 و الكازين كانت قيمه 88.0, 96.03, 83.3% و 1.2جم بروتين/ 100مل لبن على التوالي. كانت تكلفة الأغذية الناتجة أرخص خمس إلى ثمان مرات من أغذية الأطفال المحلية مثل ريرى و سيرلاك. علاوة على السابق كانت هذه الأغذية شهية, عالية القيمة الغذائية و مقبولة حسيا.

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