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CHEMICAL AND MICROBIOLOGICAL EVALUATION OF SOME INFANT FORMULAS HANDLING IN EGYPTIAN MARKETS

Youssef, Mervat S. H.; M. A. Atwa; Neamat I. Bassuony and M.F. Abol Ela

Central Lab. For Food & Feed, Agriculture Research Center- Giza

ABSTRACT

The chemical composition , nutritive value and microbial load of some commercial infant formula samples collected from different supermarkets and pharmacies from different places in Cairo , Egypt during 2005-2006 were evaluated. Bacterial assessment including the analysis of aerobic plate counts (APC), Total coliform counts (TCC), faecal coliform counts (FCC), lactic acid bacteria (LAB), *Bacillus cereus* counts (BC) , yeasts (y), and the incidences of *Salmonella* spp.

All commercial infant formulas analyzed immediately after opening The initial total aerobic count of < 104 CFUg-1 (mean 7.3X 10^3 $CFUg^{-1}$) and a *Bacillus cereus* count of < 102 CFUg-1 (mean 15 CFug-1 for formula composed of rice and milk with vegetables containing bacterium) just after opening the boxes or jars of infant foods . In most cases the mean log of APC, TCC, and FCC were highest for wheat with milk, rice with vitamins, rice and milk with Protein, honey and wheat with milk and mixed fruit with wheat and milk. *Salmonella* SPP was not detected in all investigated samples .

Natural inhibitors i.e, dry carrots, acids (citric acid) and sugars (sucrose) were used to reduce the microbial load of investigated infant formulas.

Also, the study carried out to asses the nutritive values and chemical compositions of different types of most commonly formulas used in Egypt. Moisture , ash, crude protein, fat and crude fiber were studied. Also amino acids , minerals and vitamins values of the main infant formula samples were determined.

Keywords: Infant formulas, Bacteriological evaluation, proximate composition and natural food additives.

INTRODUCTION

Food other than breast milk is not an appropriate part of the diet during the first 2-3 months . Fore instance , food combination of cereals and vegetables or fruits can supply essential nutrients that satisfy the requirements of the infant. One of the most important parameters of infant formulas products is their chemical quality. Variety and moderation are the foundations of a well – balanced diet. Proportionately, an infant needs more protein and calories than a child or adult, and many different constituents of food – including vitamins and such minerals as iron-are essential for normal growth and development. On the other hand, Microbiological examination of baby foods, is considered one of the most important determination which could be evaluated during and after the production of processed foods. It is also used as an index testing the sufficiency of the processing operation for the microbial aspects and the sanitary condition of the production. The main purpose of microbial examinations is the detection. of pathogenic microorganisms, to insure that processed foods are safe, especially in baby foods(Tamborlane,1997). Also he investigated that Cereals the best solid food to feed an infant first is an iron- fortified infant rice or barley cereal. Rice

or barley cereals are easily digested, provide an excellent source of iron, and are the least allergenic of the grain foods.

Golenkova (1974), presented the analytical data for 6 kinds of conned baby foods (various vegetable soups with rice, meat or liver). The greatest content of protein was found in soup with meat or liver, the lowest was found in soup with rice. The amino acid composition at all 6 products was very similar. The highest level of amino acids were that of products which contained reasonable amount of lysine, arginine and histidine. These latter 2 amino acids were detected in products based on meat or liver.

Abrahamsson and Hambraeus (1977) investigated the nutritive value of different types of processed milk or milk cereal based baby foods most commonly used in Sweden. They found that cereal – milk based gruels and cereal- milk based porridges contained 16-20 and 14-16% crude protein: 11-28 and 6-8.5 % fat, 36-58 and 68-70% carbohydrates. respectively.

El – Tarras *et al* (1980) evaluated the nutritive value of three commercial baby foods as infant food in Egyptian market. They revealed that protein, fat , total carbohydrates and ash contents ranged form 11.02 to 29.04%, 7.4 to 16.18%, 23.2 to 42.7% and 1.87 to 5.6 % respectively. Also ,they examined three types of commercial weaning foods in Egypt for calcium and iron contents. They revealed that calcium and iron ranged from 325 to 725 mg/100g powder and from 2.5 to 13 mg/100 g powder respectively. Vitamin A was determined in 77 samples of fortified infant formulas manufactured by 4 firms in the United States from 1981 to 1983. They revealed that the vitamin content ranged between (248-614). Mean value of 454 I.U./ kg. In addition, they noted that the formulas met the requirements of the 1980 infant formula act. Except for one sample that contained 248 I.U. vitamin A/ kg.

Khan and kissana (1985) determined the nutritive value of some commercial baby foods commonly consumed in Pakistan and revealed that the protein content of cereal- milk blends ranged from 11.1 to 13.2 % , fat ranged from 3.0 to 7.8 %, available carbohydrate ranged from 71.5 to 77.7 %, ash ranged from 2.0 to 3.3 % and calories ranged from 349 to 391 kcal, 100g.

Sotelo *et al* (1987) determined protein quality and chemical composition in Mexico of three commercial infant formulae (i) calcium caseinate. (ii) soybean based powder and (iii) dried milk and revealed that protein and fat contents for the formula were: (i) 88 and 2% (ii) 22 and 18% and (iii) 26 and 28% respectively. In other study (1987) they evaluated the nutritive value of chickpeas and soybean infant formulas. They found that the chemical composition of the formulas based on chichpeas and soybeans were: protein 2.46 and 2.86%; fat 2.04 and 3.34 % carbohydrates 11.2 and 6.89 % and minerals 0.3 and 0.5% respectively.

Darwish *et al* (1990) examined six types of different brands of weaning foods for their chemical constituents in Egypt. They found that moisture ranged from 1.49 to 3.20 %, total protein ranged from 10.3 to 18.16%; total fat ranged from 2.21 to 25.36%; total carbohydrates ranged from 48.10 to 79.95%; fiber ranged from 0.05 to 0.91% and ash ranged from 1.27 to 4.46%

Fourty samples of 15 different infant formula available in Santa cruz, Tenerife were analyzed microbiologically by Rull and Lopez (1986). They found that 37 samples had counts of < 1000 aerobic mesophilic organisms/gm. and 38 contained < 1000 aerobic thermophilic organism/gm. On the other hand no sample contained > 1000 sporeformers/gm. No coliforms, Staphylocci or *Bacillus cereus* were detected. In addition, high quality of all tested products was noted.

Fifty seven samples of infant foods were examined for their microbial contents by Rosa *et al* (1979) in Spain. Samples included humanized milk , milk based and non-milk based cereal foods. The results showed that 22.5% of samples contained> 50.000 aerobic bacteria/gm, 24% contained > 50.000 thermophilic bacteria/gm, 23.5% contained > 300 moulds and yeasts/gm only 4.8 % contained low counts of coliforms< 10/g, and 19.3 % contained > 100 Enterococci. No pathogens were detected in any sample.

Russell and Could (1991)examined the effects of various prepared natural foods, salts, acids and sugars on the microflora of these products. They found that, citric acid has great effect in the resistance of gram negative bacteria and it has important function as a food preservation when food spoilage is the result of gram- negative bacteria.

While Abd El- Raouf (1997) investigated that , the addition of lemon juice and hot spices to the koshari (Egyptian food) are necessary to the reduction of the pathogens numbers. Meanwhile Ocana- morgnert and Dankeit (2001) elucidation of the mechanisms of complement resistance of Gram-negative pathogens would being important information about bacterial infections .

In this respect Toller and Christian (1978) reported that, the addition of glucose to the sucrose used for confectionery products can permit the heat destruction of *Salmonella* spp, also Newton and Gill (1981) ,Russell and Could (1991) and Leistner (1988) noticed that the presence of glucose on the surface of meat lead to decrease the numbers of contaminated bacteria

While Babic *et al* (1994) suggested that the purified ethanolic extracts of peeled and shredded carrots showed an antimicrobial effect against a rang of food- borne microorganisms, although the antimicrobial activity was present in fresh carrots at concentrations sufficient to inhibit spoilage bacteria.

The purpose of this study was to evaluate the chemical composition and the microbiological contamination of commercial infant formula available in Egypt. Also, the effect of various prepared natural foods on the microflora of these products.

MATERIALS AND METHODS

The present work was carried out in the central laboratory for food and feed, Agric. Res. Center, Giza

Sample collection

One hundred and seventy of processed commercial infant formulas produced from different combines namely Gerber, Nestle , and Ryri were collected from different markets and pharmacies from Cairo city, Egypt . After that, the samples were investigated as representative of two leading brands.

1-Powdered infant formulas which consists of powdered milk , cereals and both dried vegetables and fruits packing in cartoon boxes

2-Ready food infant formulas which present in the form of mixtures contained of vegetables and fruits and /or vegetables with turkey or chicken present in glass jars packaging .

To ensure that contamination of infant formulas from the out side did not occur the outer packaging were sterilizing by swabbing with 70% alcohol.

Samples were divided randomly into 17 groups according their contents

Bacteriological evaluation

Appropriate dilutions prepared from each sample were used for inoculating different nutrient and selective media. The microbial determinations were applied as follows:

Total aerobic viable counts:

Aerobic bacterial counts were estimated on glucose yeast extract nutrient agar medium as the method reported by (APHA, 1990) using pouring plate technique. Suitable plates were counted after incubation at 37°C for 48 hours.

Coliform and faecal coliform counts

Coliform and faecal coliform counts were estimated on MacConkey agar (APHA,1990) using pouring plate technique. Suitable plates were counted after 24 hours at 37°C and 44.5°C for total coliform and faecal coliform counts, respectively.

Detection of *Salmonella*:

The methods of Georgola and Boothroyd, 1965 and Khan and McCaskey, 1973 was applied by adding 225 ml peptone water as pre-enrichment medium to twenty-five g of each sample and incubated at 37°C for 24 hours. After incubation , the culture was streaked on difco brilliant green agar plates and examined after 18-25 hours (On this medium, presumptive *Salmonella* appears as pink colonies surrounded by bright red medium.

Bacillus cereus:

The numbers of *B. cereus* were estimated on egg-yolk polymyxin agar medium according to Kim and Geopfert (1971). On this medium, presumptive *B. cereus* appears as large pink colonies.

Yeasts:

Total counts of yeast were determined on Rose-bengal chloramphenicol agar according the methods described in Oxoid manual (2000). Plates were incubated at 22-25°C for 7 days .

Lactic acid bacteria

Total counts of lactic acid bacteria were determined on Man, Rogosa and Shrape (MRS) agar as described in Oxoid manual (2000). Plates were incubated at 35°C for 2 days .

Evaluation of some natural inhibitor on total count bacteria

In this experiment , the natural inhibitor like sugar, lemon and dry carrots were used to test their effete on total count of bacteria according to Abdel- Rauf (1997), Toller and Christian (1978) and Babic *et al.* (1994) these

natural inhibitors were added at ratio of one spoon (5 ml) to 100 ml of total bacterial count medium.

Chemical analysis

Proximate composition

Moisture, ash, Crude protein, fat and fiber contents were determined according to (A.O.A.C 1990).

Determination of amino acids:

Individual and total amino acids were determined in 4 samples of Vegetables with chicken , turkey with rice, wheat with milk , and honey and wheat with milk. According to the method described by Widner and Eggum (1966). Oxidation was carried out using performing acid, to protect methionine and cysten from destruction during acid hydrolysis, which was then hydrolyzed using 6NHCl in the oven at 110°C for 24 hours. High performance amino acid analyzer Beckman 7300 was used to determine amino acid .

Determination of minerals:

Levels of calcium as a major mineral and iron as a minor mineral were determined using an atomic absorption, perkin Elmer, Model 2380, according to the method described in AOAC (1994).

Determination of vitamins

Vitamin A (retinol) was measured as described by Leth & Jacobsen, (1993) using Beckman HPLC.

Vitamin B1 (Thiamine) and vitamin B2 (riboflavine) were measured by HPLC as described by Bognar (1992)

Vitamin C was measured as described by NFAD (National Food Agency Institute of Denmark ,1996) using HPLC.

pH values:

The value of pH was measured according to Ling (1963).pH values of samples were estimated by means of an electric pH-meter (Wissenschaftlich-Technisch Werkstatten D 8120 Weilheim PH40) .

RESULTS AND DISCUSSION

Bacteriological quality of formulated commercial infant foods:

The mean aerobic plate count, total coliform, feacal coliform, *B.cereus*, lactobacillus bacteria, yeast, and incidences of *Salmonella* spp. are shown in tables (1) and (2). The mean aerobic plate count of wheat with milk, mixed fruit with wheat and milk, rice with vitamins and rice with milk were 2.5×10^4, 2.4×10^3 , 1.2×10^4 and 1.8×10^4 CFU/g. only 13 of 170 samples had total aerobic counts higher than the recommended safety as shown in table (1). The mean total aerobic count for all infant foods analyzed was 7.3×10^3 CFu/g.). Fore stances , All samples, having total aerobic counts (APC) less than the recommended safety limit of 10^4 CFu/g proposed by the International Dietetics Association of the European community (IDAEC) and the Egyptian standards.

These findings are consistent with the quality of dried infant formulas examined in other countries, where the mean total aerobic counts obtained

from 26 Italian and 78 Japanese infant formula did not exceed the recommended 10^4 CFU/g (Fininoli and Rondini 1989, and veda *et al* 1980).

Table (1): Total Aerobic plate counts (APC) of examined infant formulas.

Sample type	No of samples	No of samples with TAC log (CFU g^{-1}) In the range of:				TAC (mean) CFU/g
		<1.0	1.0-3.0	>3.0	>4.0	
Mixed vegetables	10	-	-	10	-	$1.1X10^3$
Mixed fruit desert	10	-	3	7	-	$1.4X10^3$
Vegetables with chicken	10	2	2	6	-	$8X10^2$
Turkey with rice	10	-	-	10	-	$6X10^3$
Rice and milk with vegetables	10	-	-	10	-	$1.2X10^3$
Wheat with milk	10	-	-	6	4	$2.5X10^4$
Mixed fruit with rice	10	2	1	7	-	$1.6X10^3$
Rice with vitamins	10	-	-	8	2	$1.2X10^4$
Rice and milk with protein	10	-	-	8	2	$1.8 X10^4$
Orange and rice with milk	10	-	2	8	-	$3 X10^3$
Mixed fruit with wheat and milk	10	-	-	7	3	$2.4 X10^4$
Mixed vegetables with wheat and milk	10	-	-	10	-	$1.9 X10^3$
Honey and wheat with milk	10	-	-	9	1	$1.3 X10^4$
Apple sauce	10	-	10	-	-	$2 X10^2$
Carrot	10	10	-	-	-	0.0
Apricot	10	10	-	-	-	2 X10
Rice and chocolate with milk	10	-	-	9	1	$1.5 X10^4$
All	170	24	18	115	13	$7.3 X10^3$

Table (2): Counts of total coliform, faecal coliform, lactobacillus bacteria, *B.cereus*, incidence of *salmonella* spp. and yeast in examined infant formulas.

Sample type	TCC	FCC	LAB	*B.cerous*	*Salmonell* spp	Yeast
Mixed vegetables	3X10	0.0	0.0	0 0	-ve	0.0
Mixed fruit desert	9X10	7	0.0	0.0	-ve	0.0
Vegetables with chicken	1 X10	0.0	0.0	0.0	-ve	0.0
Turkey with rice	$3 X10^2$	5	0.0	0.0	-ve	0.0
Rice and milk with vegetables	$1X10^2$	$2.5 X10^2$	$3.5 X10^2$	15	-ve	0.0
Wheat with milk	$2.7 X10^2$	2.5 X10	$7 X10^2$	0.0	-ve	0.0
Mixed fruit with rice	$2.8 X10^2$	7 X10	$2 X10^2$	0.0	-ve	0.0
Rice with vitamins	$20 X10^2$	4 X10	$1 X10^2$	0.0	-ve	0.0
Rice and milk with protein	$5.2 X10^2$	0.0	$1 X10^3$	0.0	-ve	0.0
Orange and rice with milk	4 X10	1 X10	$3.5 X10^2$	0.0	-ve	0.0
Mixed fruit with wheat and milk	$1.5 X10^2$	$2.6 X10^2$	$1.2 X10^3$	0.0	-ve	0.0
Mixed vegetables with wheat and milk	$2.5 X10^2$	2.5 X10	$8.8 X10^2$	0.0	-ve	0.0
Honey and wheat with milk	$4.2 X10^2$	7.5 X10	$1.6 X10^3$	0.0	-ve	0.0
Apple sauce	7 X10	2 X10	0.0	0.0	-ve	0.0
Carrot	0.0	0.0	0.0	0.0	-ve	0.0
Apricot	1 X10	0.0	0.0	0.0	-ve	0.0
Rice and chocolate with milk	1.10^2	0.0	0.0	0.0	-ve	0.0

From the results presented in table (2), it is evident that the total coliform counts ranged between 0.0 to $5.2 X10^2$ CFU /g, while , the faecal coliform counts withen range of 0.0 to $2.6X10^2$ in the same infant formula samples. Therefore, these results was not agree with the recommendations

of standards proposed that infant formulas should be free from coliform bacteria.

On the other hand ,all tested samples were negative and free from *salmonella* spp. and yeasts .

However lactic acid bacteria and faecal coliforms were found in 40% of the tested samples where lactic acid bacteria counts were ranged from 0.0 to $1.6X10^2$ CFu/g.

The groups of mixed fruit with wheat and milk , vegetables with rice and milk, honey and wheat with milk, and wheat with milk showed the highest APC and total coliforms contamination while the samples contains milk showed the lowest microbial load. Also, mixed vegetables, mixed fruits, carrot, and apricot were lowest microbial load.

The highest number of *B.cereus* observed from the samples contains rice and milk with vegetables which was $2X10^1$ CFu/g ,while the mean was $1.5X10^1$ CFu/g in the same group. These results are in agreement with those obtained by (Becker *et al* 1994). They reported that 54% of 261 samples of infant food distributed in 17 countries were contaminated with *B.cereus* reaching levels of 0.3-600 CFU/g. while, 17% of British dried infant milk formulas were contaminated by *B.cereus* as reported by (Rowan *et al*,1997)

The current results indicated that the incidence of *B.cereus* in tested samples was similar to the limit of recommended Egyptian Standard (0.0 CFU/g) in all types of infant formulas.

The obtained results could be explained by low moisture contents as a result of drying and some of the initial processing treatment, such as washing and blanching.

The effect of some natural inhibitors i.e, sugar, lemon, and dry carrot on the total aerobic bacteria for examined infant formulas were presented in table (3).

The obtained data indicated that the addition of lemon juice to infant formulas was more effective for reducing the total aerobic bacteria, which recorded the numbers of $2.5X10^4$ to $1X\ 10^3$ CFU/g in wheat with milk samples and from $1.2X10^4$ to $3X10^2$ CFu/g in rice enrichement with vitamins.

Also these results are similar with that mentioned by Russell and Could (1991) who suggested that citric acid (lemon juice) effect is most important effect in over coming resistant of gram- negative bacteria. These findings may be due to the reduction of pH values as shown in the same table.

The addition of sugar to the investigated samples was used to reduce the total aerobic bacteria as seen in table (3), which showed a decrease in the numbers from 1.2×10^4 to $0\ 6 \times 10^3$ CFU/g in rice with vitamins samples. Russell and Gould (1991) reported that sucrose is used to reduce the a_w of the media and this technique inhibits the presence of microorganisms.

Regarding the addition of carrot extracts, data indicated that the effects on the numbers of total aerobic bacteria was achieved as a result of inhibition effect of antimicrobial compounds of carrot. Antimicrobial compounds of carrot play a major role in the resistance to microbial load (Babic *et al* 1994) .

The pH values were determined for all tested infant formulas samples which ranged from 4.96 to 6.55 as shown in table (3).

Table (3): Effect of some natural inhibitors i.e, Sugar, Lemon and dry Carrots on the total aerobic plate (APC) counts of bacteria for tested infant formulas.

Samples type*	Total aerobic plate counts (APC) CFu/g							
	Before addition	Initial pH	Sugar	Final pH	Lemon	Final pH	Dry Carrots	Final pH
Mixed vegetables	1.1×10^3	5.44	5×10^2	5.54	3×10^2	3.77	2×10^2	5.20
Mixed Fruit desert	1.4×10^3	4.96	8×10^2	5.04	5×10^2	3.50	4×10^2	5.0
Turkey with rice	6×10^3	5.64	3×10^3	5.75	2×10^3	3.73	2×10^2	5.3
Wheat with milk	2.5×10^4	6.11	1.5×10^3	6.26	1×10^2	4.13	2×10^2	5.85
Mixed Fruit with rice	1.6×10^3	6.44	1×10^3	6.33	5×10^2	5.32	2×10^2	6.0
Rice with vitamins	1.2×10^4	6.39	6×10^3	6.48	3×10^2	5.35	2×10^2	6.0
Rice and milk with milk	1.8×10^4	6.43	8×10^3	6.55	6×10^2	4.45	5×10^2	6.2
Orange and rice with milk	3×10^3	6.42	3×10^2	6.53	2×10^3	4.37	1.5×10^3	6.3
Mixed fruit with wheat and milk	2.4×10^4	6.35	10×10^3	6.32	10×10^2	4.21	1.5×10^2	6.2
Mixed vegetables with wheat and milk	1.9×10^4	6.29	10×10^3	6.41	6×10^3	4.4	6×10^2	6.1
Honey and wheat with milk	1.3×10^4	6.29	10×10^3	6.96	10×10^2	4.26	5×10^2	6.2
Rice and chocolate with milk	1.5×10^4	6.55	10×10^3	6.63	10×10^2	4.49	10×10^2	6.4

* average of 10samples each.

Chemical Quality of formulated commercial infant foods:

The chemical analysis for different formulated commercial infant foods was presented in table (4). Results showed that, protein content of different infant foods ranged from 0.37 to 17.40. The highest protein content was in dried formula contains milk (14 – 17 g/100g sample), while mixed fruit desert, mixed vegetables, Apple sauce, carrots and apricot showed the lowest protein content ranged from 0.5 – 1.23 g/ 100 g sample while,the protein contents of vegetables with chicken and rice with turkey were varied from 2.75 to 3.18 g/100 g sample.

These results are agreement with those obtained by Abu Salem and Khalaf (1988). Ready to eat infant formula showed the highest moisture content (55 to 90 g/ 100 g sample), while dried infant formula samples showed the lowest moisture content (4.8 to 6.1 g/100 g sample).

The fat content was ranged from 0.15 g/100 g sample of vegetables to 2.18 g/100 g sample of mixed vegetables or fruits with wheat and milk.

The total carbohydrates was calculated by difference as shown in the same table which indicated that formulas contains cereals (wheat and rice) and/or carrot may be lead to rich sources of carbohydrates. These percentage ranged from 4.5 g/100 sample of apricot to 86.57 g/100 g sample of rice with vitamins.

Also, fiber and ash content of infant formula samples were determined as shown in the same table.

Table (4): Chemical Composition of examined infant formulas samples (per100 g sample).

Type	Sample	Protein	Fat	Crude Fiber	Ash	Moisture	Carbohydrates
Ready to eat infant formula	Mixed vegetables	1 23	0.15	1.08	0 23	90 20	7.11
	Mixed Fruit desert	0.62	0.41	1.05	0 26	79.30	18 36
	Vegetables with chicken	2.75	0.02	1.01	0 23	85 50	10.49
	Apple sauce	0.55	0.15	0.88	0 21	90.70	7.51
	Carrot	1.20	0.14	0 98	0 50	55 20	41 98
	Apricot	0.37	0.13	0.87	0 23	93.90	4 50
	Turkey with rice	3.18	0.04	0 98	0 25	86 20	9 35
Dried infant formula	Rice and milk with vegetables	16.75	0.56	0 97	4 43	5 70	71 59
	Wheat with milk	17.12	1.95	0.53	3.49	6.0	70.91
	Mixed fruit with rice	15 7	0.45	0.46	3.66	4.70	75.03
	Rice with vitamins	6.65	0.33	0 19	1.46	4.80	86.57
	Rice and milk with protein	17.40	0.85	1.01	3.44	5 90	71 40
	Orange and rice with milk	16 05	0.49	0.67	3 50	4.80	74.44
	Rice and chocolate with milk	16.87	0.51	0.54	4 02	6 40	71.66
	Mixed fruit with wheat and milk	14.92	2.18	0.57	3 65	5.80	72.88
	Mixed vegetables with wheat and milk	14.57	2 19	1.92	3 12	5 60	72.60
	Honey and wheat with milk	15.44	0.99	0.51	3.44	6.10	73.52

Amino Acids Composition:

Amino acids of vegetables with chicken, turkey with rice, wheat with milk and honey with wheat and milk as g/100 g dry matter of sample were presented in table (5). The results indicated that turkey with rice and wheat with milk contained the highest amount of total amino acids being 20.29 and 19.15 g/100 g dry matter of sample.

The acidic amino acids (Aspartic acid and Glutamic acid constituted about 31.5% of the total amino acids of turkey with rice samples. The corresponding values for aspartic and glutamic acid,were 2.03 and 4.05 g/100 g dry matter.

The basic amino acids (Lys, His, and Arg constituted about 21.2% of chicken was noticed for turkey with rice, wheat with milk, and honey with wheat and milk.

Regarding the natural amino acids (Thr, ser, pro, Gly, Ala, val, leu, and I leu ,as shown in table (5) proved that they comprised the major parts of the total amino acids of the analyzed samples.

On the other hand, the cystein and methionine amino acids showed the lowest values and therefore it considered as the limiting amino acids.

These results are in agreement with other studies by Abu Salem and Ahmed (1988).

Vitamins and minerals:

The obtained results in table (6) showed the contents of some vitamins and minerals of the tested samples.

Vitamins are essential nutrients that allow critical metabolic processes to occur. Vitamins are essential in the baby diet because the body usually cannot manufacture them.

Vitamins A, B1, B2, and C were determined for all studied samples.

The highest vitamin A content was found for formulas contained milk which was ranged from 11540 to 28820 IU / Kg of sample.

On the other hand, formulas contained mixed fruits and vegetables showed the highest vitamins B1, B2, and C contents as seen in the same table. The content of vitamin C of mixed fruits with wheat and milk was 161.05 mg / 100 g sample. Vitamin C is abundant in fruits and raw leafy vegetables.

Table (5): Amino Acid Contents for selected infants formulas samples (g / 100 g dry matter)

Amino acid	Vegetables with Chicken	Turkey with Rice	Wheat with milk	Honey and wheat with milk
ASP	1.75	2.03	1.56	1.05
Thr	0.76	0.92	0.66	0.58
Ser	0.82	0.93	0.71	0.74
Glu	3.64	4.05	4.51	3.82
Pro	0.72	0.84	1.78	1.47
Gly	0.74	0.89	0.44	0.34
Ala	0.87	1.10	0.57	0.42
Cys	0.10	0.12	0.24	0.11
Val	0.78	0.91	0.89	0.71
Meth	0.38	0.47	0.40	0.31
ISO	0.75	0.88	0.76	0.63
LEu	1.37	1.59	1.55	1.24
Phe	0.17	0.20	0.85	0.71
His	1.06	1.25	0.77	0.66
Lys	0.91	1.06	0.95	0.80
Arg	1.76	1.95	1.51	1.19
TRYP.	1.0	1.0	1.0	1.0
Total amino acids	17.58	20.29	19.15	15.78

Table (6): Contents of some vitamins and minerals of examined infant formulas:

Sample Type	Vitamins				Minerals (mg/ 100 g sample)	
	A IU/kg	B1 mg/kg	B2 mg/kg	C mg/100g	Ca	Fe
Rice and milk with vegetables	28820	2.1377	5.66	18.40	700	6.5
What with milk	23380	1.5951	8.85	79.77	350	4.3
Mixed fruit with rice	16842	5.9490	7.81	54.59	600	5.4
Rice with vitamins	10250	1.20	3.50	17.97	650	6.2
Rice and milk with protein	23410	1.02	4.85	76.66	535	5.6
Orange and rice with milk	16240	6.3662	4.63	26.11	600	4.9
Rice and chocolate with milk	23210	9.4566	5.01	75.15	570	5.1
Mixed fruit with wheat and milk	11540	7.656	8.34	161.05	610	6.3
Mixed vegetables with wheat and milk	18070	10.7541	6.89	74.9	320	2.5
Honey and wheat with milk	21330	6.9951	7.99	75.71	330	4.5

According to the U.S Department of Agriculture (1992), calcium and iron were considered to be the major minerals in infants nutrition.

The contents of calcium and iron were calculated as shown in the same table, which indicated that formulas contained milk, vegetables and fruits may be considered rich sources of minerals especially calcium and iron.

These values ranged from 320 to 700 mg / 100 g sample for calcium and 2.5 to 6.5 mg / 100g sample for iron.

These results are in general agreement with those obtained by khan and Eggum (1979).

The obtained results showed that the chemical composition of tested samples were within the limit of dietary food ordinance recommended by Egyptian Organization for Standardization and Quality Control (2005) which suggested that the chemical composition standards for weaning food mixtures were: moisture % not increase than 7% Ash % not increase than 3%. Fiber% not increase than 1%, Protein % not to less than 15%. Quality of protein not become less than 70% of casein quality. Vitamin A not become less than 1500 IU/100g. Vitamin C not become less than 25 mg/100g.

In conclusion, infant formulas commercially available on Egyptian markets examined immediately after opening of satisfactory microbiological and chemical quality.

As the bacterial flora of inadequately stored processed infant formulas may proliferate to unacceptable levels, these foods should be consumed directly after preparation and not retained as leftovers for future use. The producers of these kinds of products should pay more attention to raw material quality.

In general, the consumer can reduce the risk of bacterial contamination by addition of any of the tested inhibitors i.e, sugar, lemon or dry carrot as a natural food additives and also as natural inhibitors.

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تقييم الجودة الكيماوية والميكروبيولوجية لبعض أغذية الأطفال المتداولة في الأسواق المصرية.

ميرفت سيد حسن، محمد عبد المطلع عطوة، نعمات إبراهيم بسيونى و محمد فتحى أبو العلا

المعمل المركزى للأغذية والأعلاف – مركز البحوث الزراعية – جيزة – مصر.

أجريت هذه الدراسة بتجميع ١٧٠ عينة للأغذية **المتداولة في الأسواق المصرية** و التي تنتجها بعض الشركات بحيث تمثل هذه العينات محافظة القاهرة بجمهورية مصر العربية وقد تم دراسة الآتي:

العد الكلى للميكروبات الهوائية والعد الكلى لبكتريا مجموعة القولون والفيكال وبكتريا حامض اللاكتيك والخمائر وكذلك تم الكشف عن مدى تواجد ميكروب السالمونيلا مع اجراء العد الكلى لميكروب الباسيلس سيريس.

وقد أوضحت النتائج أن معظم العينات كانت بحالة ميكروبيولوجية جيدة فقد كان متوسط المحتوى الكلى للكبتريا الهوائية هو ٧,٣ × ١٠^{٣} خلية لكل جرام عينة بينما كان لميكروب الباسيلس سيريس ١٥ خلية لكل جرام عينة هذا وقد لوحظ من الدراسة ان العد الكلى للبكتريا الهوائية وكذلك لبكتريا مجموعة القولون كان غالبا في عينات القمح واللبن وكذلك الأرز المدعم بالفيتامينات والأرز بالبروتين والقمح بالعسل واللبن والخضروات مع اللبن.

هذا وتشير النتائج الي خلو جميع العينات التي تم دراستها من ميكروب السالمونيلا. و من ناحية اخري فلقد اجري دراسة تأثير اضافة بعض المثبطات الطبيعية على العدد الكلى للبكتريا الهوائية في أغذية الأطفال مثل الجزر المجفف والسكر والليمون.

وقد أوضحت نتائج أن التحليل الكيماوي لمعظم العينات من حيث تقدير (الرطوبة – الرماد – الألياف – البروتين – الفيتامينات – الأحماض الأمينية – العناصر المعدنية – الكربوهيدرات) كانت في المستويات القياسية تبعا للمواصفات القياسية المصرية.