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Production of Nontraditional Food for Children after Weaning

El-Sisy, T.T.[1]; Marwa H. El-Gendy [2] and Soad A. Ali [3]
[1] Regional Center for Food and Feed, Agriculture Research Central.
[2] Animal and Poultry Production Division, Desert Research center, Cairo, Egypt.
[3] Cairo University Hospitals, Kasr El-Aini St., Cairo, Egypt

ABSTRACT

This study aimed at manufacturing of camels' milk, and its yogurt made with barley and certain fruits and vegetables for the benefit of feeding children after weaning. Different technological options were assayed, including characterizing the physical, chemical, microbiological, functional and sensory properties. The chemicals composition between different camels' milk being fermented and non-fermented for fortified barley, fruits and vegetables products for children nutrition are significant ($p \leq 0.05$). The total viable count in the samples was higher due to the increase of the solids. The viscosity of fermented camels' milk was also better than non-fermented camels' milk. The effect of children food fermented camels' milk for fortified barley, fruit and vegetables had the highest antioxidant activity. Sensory evaluation of children food showed that fermented camels' milk fortified with barley and fruits better of overall acceptability of appearance, color body, texture and flavor than non-fermented camels' milk fortified with barley and fruits. In contrast, fermented camels' milk made from barley and vegetables were less than those made from non- fermented. Economic evaluation for children food made to camels' milk (fermented and non- fermented) showed it is cheapest than the commercial children food. Finally, in the case of manufacturing of children food after weaning from non-fermented camels' milk fortified with barley prefers mixed vegetables, while it may be fermented camels' milk when mixed with fruit.

Keywords: Barley, Fruits, Vegetables, Camel Milk and Camel Yogurt.

INTRODUCTION

Milk and dairy products contribute a great importance in diets for children and adults, and some special cases of calcium and protein, energy and other micronutrients. More of reports indicate the camel milk has many health benefits they are antimicrobial (Al-Haj and Al Kanhal, 2010) and anticancer (Kula 2016) and contribute to the treatment of many diseases (Musaad et al, 2013, Bhagiel et al, 2015 and Abdel-Galil and Alhaider, 2013). Al-Hammadi et al. (2010), Kumar (2015) and Kula (2016) were used camel milk as an alternative to bovine milk in children with food allergies.

As well as, whole grain cereals together with fruits and vegetables are excellent sources of dietary fiber (Harris and Ferguson, 2014). On the other hand, Experimental studies indicate that consumption of grains; fruits, vegetables and fermented milk products are related to public health (Miller, 2000, Mozaffarian et al., 2011, Astrup, 2014). Cao et al (1998) showed that when you eat fruits and vegetables, they contribute to the high level of antioxidant activity in the blood. More recently, increased interest in antioxidants in grains, fruits and vegetables in many applications because of its ability to improve the quality and safety of food and to promote the health benefits for humans (Miller et al 2000). Yogurt is one of the most consuming fermented dairy products in the world because of its sensory properties and nutritional value and therapeutic high. Fruit yogurt from more dairy products fermented salability by consumers, especially children, by adding seasonal fruits to yogurt (Tarakci. and Kucukoner, 2003, Sarmini et al. 2014, Ali, 2016). Damunupola et al. (2014) and Srivastava et al. (2015) showed that added vegetables to yogurt increases the health benefits of yogurt.

Cereals have higher content of dietary fiber, minerals, vitamins and antioxidants than milk (Charalampopoulos et al., 2002 and Kreisz et al., 2008). Barley (*Hordeum vulgare*) is distinctive among cereal crops because of its high concentration of dietary fiber, particularly mixed linked (1→ 3) (1→ 4) - β -D glucans (Freimund et al., 2003, Soares and Soares, 2012). The β-glucan from barley grains has been shown to have an important influence on human glycemic control. Incorporation of β-glucan directly into foods imparts nutraceutical properties to food and resulted in reduction of postprandial blood glucose (Wood et al., 1990) and (Wood, 1993). Nutraceuticals are defined as any substance that is a food or part of a food that provides medical and/or health benefits. (Defelice, 1995). Previous studies have established the positive association between intake of dietary fiber and decreased risk of several diseases such as colorectal or cardiovascular diseases cancer (Peters et al., 2003). Adequate fiber intake has also been shown to improve glucose/insulin metabolism and lower plasma lipid concentrations in type 2 diabetes patients (Chandalia, 2000).

El-Gendy et al. (2016) indicated to the importance of the use of fermented camel milk fortified grains in it's healthy products. Also, that camel milk fermented drinks fortified cereals contribute to reducing the risk of diabetic complications (Ali et al., 2016). EU (2013) has identified certain principles and guidelines when accredited manufacturing baby food grain and additions permitted. There are currently in the market for children food based on milk and cereals (Meade et al., 2005) or grains, fruits and vegetables, with a period of great validity.

Given that food and biological value of milk improved when used in the case of fermented, and the importance of grains, fruits and vegetables, it has been proposed to use those components in the production of a safe product for children food. also, all the blends must be meet the requirements for children after weaning food in terms of the protein, carbohydrates, fats, minerals and vitamins (EU, 2013).

This study aimed at manufacturing and characterizing the physical, chemical, microbiological, functional and sensory properties of camel milk and its yogurt made with barley and many fruits and vegetables for the benefit of feeding children after weaning.

MATERIALS AND METHODS

Barley (*Hordeum distychum*) of USA origin was obtained from Regional Center for Food and Feed, Agriculture Research Central, Cairo, Egypt. Four local fruits were Apple *(Maius domestia)*, Black berries *(Rubus. Laciniatus)*, Banana *(Musa acuminata colla)* and Guava *(Psidium guajava)* were obtained from Cairo Governerate market.Seven local vegetables namely, yellow sweet *potato (Ipomoea batatas)*, orange carrot *(Daucus carota)*, beet *(Beta vulgaris)* spinach *(Spinacia oleracea)*, shives *(Allium schoenoprasum)*, parsley *(Petroselinum crispum)* and celery *(Apium graveolens)* were obtained from Cairo governate.

Camel's milk was obtained from the herd in Maruot Research Station, Desert Research Center, Alexandria Governorate. All animals were kept under the same conditions. Bulk camels' milk samples were analyzed for chemical composition. The commercial freeze-dried DVS mixed bacterial starters of (YC-X11 Yo -Flex®, Chr. Hansen, Honsholm, Denmark) (containing of *Lactobacillus delbrueckii ssp. bulgaricus* and *Streptococcus thermophilus*) as yogurt were used in the fermentation process. Freeze-dried bacterial starters used in the fermentation process were prepared as mother cultures in autoclaved (121°C/10 min) fresh buffaloes' skim milk (0.1 % fat and 9.5% SNF) using a 0.2 % (w/v) inoculums. The cultures were incubated at 40˚C for YC-X11 starter until curdling of milk. Cultures were prepared 24h before use.

For making yogurt, camel's milk was heated at 95 ºC for 5 minutes, Then, inoculated at 42 ºC with a yogurt starter consisting of YC-X11 starter and incubated at 40°C until the pH reached 4.5. The yogurt was then cooled to 5°C and stored at 5°C.

Grain samples (barley) were stored at temperature 25°C and relative humidity less than 62% and taken samples from stores according to the methods described in USDA, (1995). Barley were cleaned mechanically to remove dirt, dockage and other strange grains by Carter Dockage tester, and pearled by barley pearled according to the methods described in USDA, (2002). Fruits and vegetables samples were cleaned handily to remove dirt, dockage and other strange plants herbs.**:**

For making children food from fermented and non-fermented camel milk fortified with cereal, fruits and vegetables, barley was boiled in distilled water in a pan, and simmered until the liquid was absorbed and become soft. This cooked barley were grinding using kenwood mixer (Kenwood Limited, 1 Kenwood Business Park, New Lane, Havant, United Kingdom). Camels' milk, yogurt camel milk, cooked barley, fruits and vegetables were used to produce children food according to the formula showed in Table (1).

Table 1. formula of children fruits and vegetables foods

Type of children food		Components								
Fruits	T1	Guava 6.25%	Black berries 6.25%		Apple 6.25%	Banana 6.25%		Camel milk 25%		Barley 50%
	T2	Guava 6.25%	Black berries 6.25%		Apple 6.25%	Banana 6.25%		Camel yogurt 25%		Barley 50%
	C1	Peach 19%	Apricot 5%	grape concentrate 9.3%	Apple 19%	Orange concentrate 0.8%	Banana 8%	Rice	Vit. C	water
Vegetables	T3	Yellow Sweet potato 6.25%	Orange Carrot 6.25%	Beet 6.25%	Spinach 3.25%	Celery 1%	Chives 1%	Parsley 1%	Camel milk 25%	Barley 50%
	T4	Yellow Sweet potato 6.25%	Orange Carrot 6.25%	Beet 6.25%	Spinach 3.25%	Celery 1%	Chives 1%	Parsley 1%	Camel yogurt 25%	Barley 50%
	C2	Potato 23%	Orange Carrot 15%	Green beans 10%	Green peas 5%	Celery 2%	Onion 1%	Tomato concentrate 2%	Salt and water	

C1= fruits commercial food, T1= camels' milk for fortified barley and fruits, T2= yogurt camel milk for fortified barley and fruits, C2= vegetables commercial food, T3= camels' milk for fortified barley and vegetables, T4= yogurt for fortified barley and vegetables.

For detecting the chemical and microbiological composition of barley, fruits and vegetables used, protein, fat, crude fiber, energy and were determined according to AOAC, (2005). Minerals content (Fe, Zn, and Se) were determined after aching of different samples according to AOAC (1990). Measurements were carrying out using Atomic absorption spectrophotometer model 3300 Perken for element. The data were calculated as ppm. Total mold count and fungal identification were carried out using Rose Bengal chloramphenical agar and incubated for 5-7 days at 25 ^{o}C. Fungal identification was performed for isolated fungi in Food Safety Lab, Regional Center for Food & Feed, Agriculture Research Center and identified according to (Samson et al. 1995). Estimation of Aflatoxins content, Ochratoxin, Zearalenone and Fumonisin were determined by HPLC using the method of AOAC (1995).

Chemical, Physical and microbiological properties of camels' fermented and non-fermented camels' milk fortified with cereal, fruits and vegetables products for children nutrition were carried out. The pH was measured using a pH-meter (HANNA-pH 210, Germany). Protein, fat, crude fiber contents and ash contents of camel milk's, its yogurt, and children fruits and vegetables foods samples were determined according to AOAC (2015). The nitrogen content of the samples was determined by the Kjeldahl method and Converted to protein content using a factor of 6.25.

For the enumeration of total aerobic bacteria (TAB), yeasts and moulds (YM) and coliform bacteria, samples of camel milk's, its yogurt, and children fruits and vegetables foods (11 ml) were dispersed in 99 ml peptone water, and appropriate decimal dilutions were prepared under the aseptic conditions. Total count of TAB was enumerated by plate count agar (Oxoid) after incubation at 37°C for 48 hours according to Marshall (1993). Dichloran Rose Bengal Chloramphenicol Agar (Oxoid) was used for YM enumeration and plates were incubated at 25°C for 5 days according to Marshall (1993). Coliform bacteria were enumerated on Violet Red Bile Agar (Oxoid) after incubation at 37°C for 24 h according to Marshall (1993).

As with the antioxidant activity, each samples extracts (250 mL) were added into 3 mL of 60 mmol/L 1,1-diphenyl-2-picrylhydrazyl (DPPH) (Sigma-Aldrich, Germany)/L in ethanol. The decrease in absorbance was monitored at 517 nm until a constant reading was obtained. The constant reading for the each samples extracts and control (consisting of 250 mL of water in place of extract) was used in calculating the % inhibition of DPPH oxidation (Apostolidis *et al.*, 2007) as follows:

$$\textbf{\% inhibition} = 100*(A_{control\ 517} - A_{extract\ 517})/A_{control\ 517})$$

Viscosity was measured using the Brookfield rotational viscometer (model Brookfield DV- III ultra programmable rheometer BROOKFIELD ENGINEERING LABORATORIES, INC., 11 Commerce Boulevard, Middleboro, USA) using No. 3 spindle at 20 rpm at 1 min intervals. Three readings were recorded for each sample.

Children food cereal based fruits and vegetables were Sensory evaluated according to the method described in Nelson and Trout (1981). The fresh sample was delivered to 10 panelists 24 hours after processing.

Economic model was developed to major components according to Wingfield (1985) and Bunn (1998).

Data of the experiment was analyzed by the General Linear Model (GLM) procedure of SAS (2004).

RESULTS AND DISCUSSION

Chemical composition and physical properties of barley, fruits and vegetables used in this study argiven in Table (2). Protein content, Barley had the highest protein (12.30%) followed by celery and chives (6.0%), while beet (1.0%) had the lowest protein content. Additionally yellow sweet potato was lower fat (<0.5) than other samples.

The results of fiber showed that barley and parsley had significant highest value (8.50%) while apple had lowest (2.40%). The energy of different varieties ranged from (1.0 to 18.09%) for all studied samples. Barley had the highest value while celery had lowest value among all samples. These results agree with result obtained by FAO (1995).

Minerals for different fruits, vegetables and grain cultivar: Data in Table (2) showed that minerals, it can be noticed that Fe no have trend for micro element which range between 2.0 to 62.0 ppm for all samples. Zn in black berries is the highest (60.0 ppm) and celery is the lowest (1.30 ppm). These results agree with result obtained by the Ministry of Health of Ukraine (2001) and Nagarajan (2005).

Table 2. proximate analysis for different barley, fruits, and vegetables.

	Grains	Fruits				vegetables						
	Br	A	Bb	G	B	OC	YSp	Be	S	Ce	Ch	P
Chemical composition %												
Protein	2.30±0.01	0.17±0.01	1.54±0.1	0.95±0.1	0.33±0.01	1.0±0.01	0.5±0.1	0.5±0.1	1.5±0.01	4.5±0.1	3.0±0.01	3.0±0.1
Fat	8.50±0.01	2.4±0.01	5.3±0.1	5.4±0.1	2.6±0.01	7.0±0.01	8.0±0.1	7.0±0.01	6.0±0.1	5.5±0.01	7.0±0.1	8.5±0.1
Fiber	18.09±0.01	2.5±0.01	2.21±0.1	3.5±0.1	4.5±0.01	2.0±0.01	4.0±0.1	2.0±0.01	1.0±0.1	<1.0±0.1	1.0±0.1	1.5±0.1
Energy	12.30±0.1	0.26±0.01	2.72±0.1	5.0±0.1	1.09±0.01	1.5±0.01	3.0±0.1	1.0±0.01	5.0±0.1	6.0±0.01	6.0±0.1	5.0±0.1
Minerals ppm												
Fe	36.6±0.1	1.2±0.01	6.2±0.1	2.6±0.01	2.6±0.01	3±0.1	6.1±0.01	8±0.1	27.1±0.01	2±0.1	16±0.01	62±0.1
Se	0.04±0.01	0.03	-	6±0.1	10±0.01	0.001±0.01	-	-	-	-	0.009±0.01	-
Zn	23.6±0.01	0.4±0.01	60±0.1	2.3±0.1	0.15	2.4±0.1	3±0.1	3.5±0.1	5.3±0.1	1.3±0.01	5.6±0.1	10.7±0.01
Vitamins ppm												
Thiamine (B1)	0.57±0.1	0.17±0.1	0.2±0.1	0.67±0.1	0.31±0.1	0.66±0.1	0.78±0.1	0.31±0.1	0.78±0.1	0.21±0.1	0.78±0.1	0.86±0.1
Riboflavin (B2)	0.22±0.01	0.26±0.01	0.26±0.1	0.4±0.01	0.73±0.01	0.58±0.1	0.61±0.01	0.57±0.1	1.89±0.1	5.7±0.01	1.15±0.01	0.98±0.1
Niacin (B3)	6.4±0.1	0.91±0.1	6.46±0.01	10.84±0.1	6.65±0.1	9.83±0.01	5.57±0.1	3.34±0.01	7.24±0.01	3.2±0.1	6.47±0.1	13.13±0.01
Pantothenic	0.73±0.01	0.61±0.01	-	4.51±0.01	3.34±0.01	2.73±0.1	8±0.01	1.55±0.1	0.65±0.1	2.46±0.01	3.24±0.01	4±0.1
Pyridoxine (B6)	0.33±0.01	0.41±0.01	0.3±0.01	1.1±0.01	3.67±0.01	1.38±0.01	2.09±0.01	0.67±0.01	1.95±0.01	0.74±0.01	1.38±0.01	0.9±0.01
Folate (B9)	9±0.1	0.03±0.1	0.25±0.01	0.49±0.1	0.02±0.1	0.19±0.01	0.11±0.1	1.09±0.01	1.94±0.01	0.36±0.1	1.84±0.1	1.52±0.01
Folic Acid	10	0.07	-	-	-	-	-	-	-	-	-	-
Vit. A	22±0.1	540±0.1	2140±0.01	6240±0.1	0.64±0.1	167.06±0.01	141.87±0.1	0.33±0.01	93.77±0.01	4.49±0.1	43.53±0.1	84.24±0.01
Vit. K	-	0.022±0.01	190±0.01	0.026±0.01	0.05±0.01	0.132±0.01	2.6±0.01	0.002±0.01	4.829±0.01	0.293±0.01	2.127±0.01	16.4±0.1
Vit. C	-	46±0.1	210±0.01	2280±0.1	87±0.1	59±0.01	24±0.1	49±0.1	281±0.01	31±0.1	581±0.1	1330±0.01
Vit. E	0.13±0.1	1.8±0.1	11.7±0.1	7.3±0.1	1±0.1	-	0.018±0.1	0.4±0.1	20.3±0.1	-	2.1±0.1	7.5±0.1
Microbiological (log cfu/g)												
TYMC	3.0	2.0	2.8	3.1	2.5	4.0	4.5	3.9	2.1	1.8	1.0	1.1

Br = Barley Two Rowed, A= Apple, Bb= Black berries, G= Guava, B= Banana, OC= Orange Carrot, YSp= Yellow Sweet potato, Be= Beet, S= Spinach, Ce= Celery, Ch= Chives, P= Parsley, TYMC =Total Yeast and Mold count

Vitamins for different barley, fruits and vegetables were used in this study given in Table (2) that Thiamine (B1) of different samples ranged from (0.17 to 0.86 ppm) for all studied samples. Parsley had the highest value while apple had lowest value among all samples. As regards Riboflavin (B2), celery had the highest (B2) (5.70 ppm), while barley (0.22%) had the lowest (B2). On other hand Niacin (B3) range from 0.91 ppm (apple) to 13.13 ppm (parsley). Additionally apple was lower Pantothenic (0.61 ppm) than other samples and black berries lower in Pyridoxine (0.30) in completely in other samples. However, highest Folic Acid was observed in American barley two rowed (10.0 ppm). On other hand, vitamin A range from 0.33 ppm (beet) to 6240.0 ppm (guava). Additionally apple was lower vitamin C (24.0 ppm) than other samples and beet lower in vitamin k (0.002 ppm) in completely in other samples. These results agree with result obtained by (FAO, 2009).

Aflatoxin content for barley can be noticed that all samples had lowest aflatoxin content before storing under detection limit (0.5ppb) for aflatoxin, ochratoxin ,zearalenone, fumonisin. Moreover it can be concluded that all sample barley under detection limit (0.5ppb) of the stander Egyptian maximum (B1=10ppb and total aflatoxin =20 ppb). Aflatoxin content was valet within the safe limit 50ml/kg recommended by FAO. Result of total yeast and mold count for barley, fruits and vegetables are present in Table (2). Data showed that total mould count ranged between 1.0 to 4.50 log cfu/g. These results agree with result obtained by FAO (1995).

The chemical composition of products for children food fermented and non-fermented camels' milk being fortified with cereal, fruits and vegetables are shown in Table 3. Fresh camel's milk is of pH 6.7, protein 3.8%; fat 3.5%; lactose 4.4%; ash 0.865% while total solid 12.6%. These results are similar to those of Al-Haj and Al Kanhal (2010). All parameters were significant ($p \leq 0.05$) in the protein, fat, ash, fiber, total solid and carbohydrate between children food fermented and non-fermented camels' milk for fortified barley, fruits and vegetables. In all samples, the pH ranged from 4.67 ± 0.02 to 6.4 ± 0.01. Total protein content in of fermented camel milk (fruits and vegetables) was highest (4.39±0.1 and 4.59±0.1 respectively) compared to control and food non-fermented camel milk (fruit and vegetables) (Table 8). These results higher than that found El-Bakri and El-Zubier (2009). The results were the same in the fat and ash content in the samples under this study, that reported by El-Bakri and El-Zubier (2009).

Table 3. proximate analysis for camels' milk and ingredients (yogurt, barley, fruits and vegetables) used manufacture children food.

	milk	Yogurt	children food barley and fruits			children food barley and vegetables		
			C1	T1	T2	C2	T3	T4
pH	6.7	4.5	4.70^{b}±0.02	6.40^{a}±0.02	4.89^{c} ±0.02	4.75^{b} ±0.02	6.30^{a}±0.02	4.67^{b} ±0.02
Protein%	3.84	3.85	0.40^{d} ±0.1	4.15^{b}±0.1	4.39^{b}±0.1	1.10^{c}±0.1	4.42^{b}±0.1	4.59^{a}±0.1
Fat%	3.50	3.55	0.10^{b}±0.05	3.85^{a}±0.05	4.00^{a}±0.05	0.10^{b}±0.05	3.95^{a}±0.05	4.10^{a}±0.05
Ash%	0.865	0.875	0.920^{b}±0.01	0.895^{c}±0.01	0.915^{b}±0.01	0.905^{b}±0.01	0.935^{b}±0.01	0.950^{a}±0.01
Fiber%	-	-	1.85^{d}±0.03	6.67^{b}±0.03	7.62^{a}±0.03	3.61^{c}±0.03	3.38^{c}±0.03	3.4^{c}±0.03
Total solid%	12.60	12.725	21.57^{b}±0.65	29.06^{a}±0.65	30.48^{a}±0.65	13.12^{c}±0.65	21.23^{b}±0.65	21.94^{b}±0.65
Carbohydrate*	4.395	4.45	18.3^{a}±0.11	13.50^{b}±0.11	13.55^{b}±0.11	7.40^{c}±0.11	8.55^{c}±0.11	8.90^{c}±0.11
Microbiological count (Log CFU/ ml)								
TVC			8.48^{ab}±0.01	8.52^{a}±0.01	8.55^{a}±0.01	8.25^{d}±0.01	8.36^{c}±0.01	8.45^{b}±0.01

C1= fruits commercial food, T1= camels' milk for fortified barley and fruits, T2= yogurt camel milk for fortified barley and fruits, C2= vegetables commercial food, T3= camels' milk for fortified barley and vegetables, T4= yogurt for fortified barley and vegetables. Protein%= T.N %× 6.38; Total carbohydrates %: Calculated by the difference, TVC= Total viable count

Total solids content also increased by adding barley, fruit and vegetables to camel milk or yogurt made from camel milk. This result confirmed El-Bakri and El-Zubier (2009). The total viable count was significantly affected ($P<0.05$) by different children food fermented and non-fermented camels' milk for fortified cereal, fruits and vegetables (Table 3). The control (commercial) different children food (fruits and vegetables) had the lowest total viable count (8.48±0.01 and 8.25±0.01 log CFU/ml) and the highest (8.55 ± 0.01 and 8.45±0.01 log CFU/ml, respectively) found in fermented camel milk (fruits and vegetables) used to manufacture children food. The total viable count in the samples was higher due to the high of the solids, and vice versa (Mahdian and Tehrani, 2007). The yeast, mold and coliform bacterial counts less than 10 CFU /ml (less than detection limit) in all transactions. It can be attributed to the high hygienic conditions followed.

Vitamins (thiamine, riboflavin, niacin, pyridoxine and vitamins A, C, E and K) content of different children food fermented and non-fermented camels' milk for fortified barley, fruits and vegetables of weaning food is given in Table (4). In general, increases in vitamins occur as a result of fermented camels' milk to non-fermented camels' milk was also reported Sanni et al. (1999).

Table 4 also shows the mean concentrations of iron, zinc, and selenium. Analyses of variance were carried out between different children food fermented and non-fermented camels' milk for fortified barley, fruits and vegetables. It were statistically significant differences ($P<0.001$). It could also be noticed that the high rate of selenium in the fermented camels' milk for fortified barley, fruits and vegetables to non-fermented camels' milk for fortified barley, fruits and vegetables. But it was contained in fermented camels' milk fortified with barley, fruits was higher in the percentage of selenium may be due to the high content of selenium in the fruit.

The effects of viscosity from children food fermented and non-fermented camels' milk for fortified barley, fruits and vegetables during storage are presented in Table 4. On the initial day, the viscosities of all treatment of fruits were the highest the control, but the control of vegetables were the highest all treatment. These results are repeated during storage periods. These results due to the fruits has a particular chemical composition, rich in fibers (mainly soluble fiber), and contains a considerable amount of starch as well as pectin polysaccharides (Vriesmann and Petkowicz, 2009) and rich β-glucan in barley (Casiraghi et al., 2006), which could improve the apparent viscosity. These results are repeated during storage periods. Generally, table (4) illustrates that the barley addition increased apparent viscosity of the fermented camels' milk more than non-fermented camels' milk. The higher apparent viscosity of fermented camels' milk for fortified barley, fruits and vegetables due to the soluble dietary fibers in fruits and vegetables which act as pectin had the ability to bind water and form highly viscous solutions tending to increase of the consistency of the fermented milk (Gad et al., 2015).

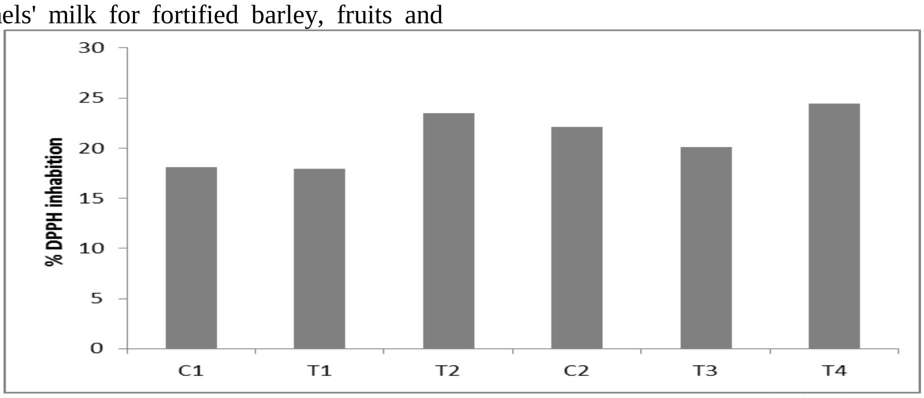
Table 4. Vitamins, minerals and viscosity for different children food cereal based fruits and vegetables.

Vitamins (ppm)	children food barley and fruits			children food barley and vegetables		
	C1	**T1**	**T2**	**C2**	**T3**	**T4**
Thiamine (B1)	0.16^{e}±0.1	0.37^{d}±0.1	0.55^{b}±0.1	0.34^{d}±0.1	0.43^{c}±0.1	0.61^{a}±0.1
Riboflavin (B2)	0.21^{c}±0.01	0.24^{c}±0.1	0.37^{b}±0.01	0.10^{d}±0.1	0.37^{b}±0.1	0.52a±0.01
Niacin (B3)	2.34^{c}±0.1	4.75^{b}±0.01	6.17^{a}±0.1	0.11^{d}±0.01	4.84^{b}±0.01	6.30a±0.1
Pyridoxine (B6)	0.51^{c}±0.01	0.58^{bc}±0.01	0.61^{ab}±0.01	0.26^{d}±0.01	0.50^{c}±0.01	0.70a±0.01
Folate (B9)	0.24^{f}±0.1	4.70^{c}±0.01	6.11^{b}±0.1	2.58^{e}±0.01	4.64^{d}±0.01	7.0^{a}±0.1
Vit. A	343.63^{c}±0.1	568.54^{b}±0.01	682.25^{a}±0.1	0.48^{e}±0.01	33.86^{d}±0.01	37.24^{d}±0.1
Vit. K	2.19^{c}±0.01	11.88^{a}±0.1	10.6^{b}±0.01	0.10^{f}±0.1	0.54^{e}±0.1	0.70^{d}±0.01
Vit. C	2.5^{f}±0.1	172.47^{b}±0.01	258.0^{a}±0.1	14.28^{e}±0.01	51.37^{d}±0.01	77.06^{c}±0.1
Vit. E	0.71^{c}±0.1	5.48^{b}±0.1	6.0^{a}±0.1	----	0.50^{d}±0.01	0.55^{d}±0.1
Minerals (ppm)						
Fe	46.23^{d}±0.04	53.70^{c}±0.04	51.69^{c}±0.04	24.36^{e}±0.04	73.66^{b}±0.04	84.93^{a}±0.04
Zn	39.64^{b}±0.06	20.88^{c}±0.06	21.24^{c}±0.06	53.19^{a}±0.06	22.96^{c}±0.06	43.64^{b}±0.06
Se	1.016^{e}±0.03	1.048^{d}±0.03	1.138^{a}±0.03	1.067^{b}±0.03	1.056^{bc}±0.03	1.060^{b}±0.03
Viscosity Cp/s						
0 day	16700^{d}±0.01	22700^{c}±0.01	24500^{b}±0.01	28800^{a}±0.01	22500^{c}±0.01	28100^{a}±0.01
3 day	13800^{f}±0.03	24200^{e}±0.03	25600^{d}±0.03	39400^{a}±0.03	32800^{c}±0.03	38200b±0.03
6 day	11200^{f}±0.1	21200^{e}±0.1	23400^{d}±0.1	55600^{a}±0.1	46000^{c}±0.1	49400^{b}±0.1
9 day	21400^{e}±0.05	21400^{e}±0.05	26600^{d}±0.05	67800^{a}±0.05	48600^{c}±0.05	55400^{b}±0.05

C1= fruits commercial food, T1= camels' milk for fortified barley and fruits, T2= yogurt camel milk for fortified barley and fruits, C2= vegetables commercial food, T3= camels' milk for fortified barley and vegetables, T4= yogurt for fortified barley and vegetables.

The natural antioxidant activities of various children food fermented and non-fermented camels' milk for fortified barley, fruits and vegetables were evaluated using the DPPH radical inhibition assay presented in Figure 1. The fermented camels' milk for fortified barley, fruit and vegetables had the highest DPPH radical inhibition activity (T2: 23.52% and T4: 24.45%).

The DPPH radical inhibition activity to commercial children food (fruit and vegetable) (18.07% and 22.21% respectively) higher then food children non-fermented camels' milk for fortified barley, fruits and vegetable (T1: 17.91% and T3: 20.09%). These results indicate that children food fermented and non-fermented camels' milk for fortified barley and vegetables of enhanced the antioxidant activity higher than children food fermented and non- fermented camels' milk for fortified barley and fruits, due to higher vitamin C and Fe content. These result was obtain Adjimani and Asare (2015). But in general, the enhancing of dairy products in fruits and vegetables contributed to the increased antioxidants activity, which contribute to improving the health status (Gad et al., 2015)



C1= fruits commercial food, T1= camels' milk for fortified barley and fruits, T2= yogurt camel milk for fortified barley and fruits, C2= vegetables commercial food, T3= camels' milk for fortified barley and vegetables, T4= yogurt for fortified barley and vegetables

The sensory evaluation of children food fermented and non-fermented camels' milk for fortified barley, fruits and vegetables which had been made showed are shown in Table 5. All sensory parameter (appearance and color, body and texture, flavor and general acceptability) of children food fermented and non-fermented camels' milk for fortified barley, fruits and vegetables had been affected.

Table 5. Sensory evaluation for different children food fermented and non-fermented camels' milk for fortified barley, fruits and vegetables

children food cereal based		Appearance and color (25)	Body and Texture (25)	Flavor (50)	General acceptability (100)
	C1	$23.6^{ab}\pm0.352$	$23.6^{ab}\pm0.369$	$44.5^{ab}\pm0.421$	$91.7^{a}\pm0.584$
fruits	T1	$18.9^{e}\pm0.352$	$19.6^{e}\pm0.369$	$42.3^{d}\pm0.421$	$80.8^{e}\pm0.584$
	T2	$20.9^{ed}\pm0.352$	$20.2^{ed}\pm0.369$	$44.9^{a}\pm0.421$	$86.0^{cd}\pm0.584$
	C2	$22.3^{bc}\pm0.352$	$23.3^{abc}\pm0.369$	$44.4^{a}\pm0.421$	$90.0^{b}\pm0.584$
vegetables	T3	$22.7^{bc}\pm0.352$	$22.3^{c}\pm0.369$	$42.1^{d}\pm0.421$	$87.1^{c}\pm0.584$
	T4	$21.6^{cd}\pm0.352$	$21.0^{d}\pm0.369$	$43.3^{bcd}\pm0.421$	$85.9^{cd}\pm0.584$

C1= fruits commercial food, T1= camels' milk for fortified barley and fruits, T2= yogurt camel milk for fortified barley and fruits, C2= vegetables commercial food, T3= camels' milk for fortified barley and vegetables, T4= yogurt for fortified barley and vegetables

Both of the control was whether made from fruit and vegetables highest in all assessments from the rest of the treatments children food fermented and non-fermented camels' milk for fortified barley, fruits and vegetables. In general, the result of children food fermented camels' milk for fortified barley and fruits higher than made from non-fermented camels' milk for fortified barley and fruits. In contrast, the fermented camels' milk for fortified barley and vegetables less than made non-fermented camels' milk for fortified barley and vegetables.

Regaring the economic evaluation, the data in Table 6 showed that the prices one kg of mixed fruits was 5.72 L.E/Kg while the prices one kg of mixed vegetables was 11.84 L.E/Kg. However the prices one kg to produce one kg of children food fermented and non-fermented camels' milk for fortified barley, and fruits (T1 and T2) were (4.93 and 5.43) L.E/Kg respectively, and the prices one kg to produce one kg of children food fermented and non-fermented camels' milk for fortified barley and vegetables (T3 and T4) were (6.46 and 6.96) L.E/Kg, respectively. While the prices one kg of commercial children fruits food (C1) was 65.38 L.E/Kg and the children food fermented and non-fermented camels' milk for fortified barley and fruits prices one kg of commercial children vegetables food (C2) was 65.38 L.E/Kg. On the other hand the prices to produce commercial component 130.0 gm of food (T1 and T2) were (0.64 and 0.71) L.E/130gm respectively and the prices to produce commercial component 130.0 gm of children food fermented and non-fermented camels' milk for fortified barley and vegetables (T3 and T4) were (0.84 and 0.90) L.E/130gm respectively while the prices commercial children fruits food (C1) was 8.50 L.E/130gm and the prices commercial children vegetables food (C2) was 8.50 L.E/130gm. So, the children food fermented and non-fermented camels' milk for fortified barley, fruits and vegetables were cheapest than the commercial children food. These results are parallel with the results obtained by Wingfield, (1985) and Bunn, (1998).

Table 6. Economic evaluation for different production of Children fruits food and Children vegetables food according to the formula showed in Table (1).

Performance	Grain	Fruits				Vegetables						
	Br	A	Bb	G	B	OC	YSp	Be	S	Ce	Ch	P
Price L.E/Kg per percentage (50%)	1.0	0.5	0.31	0.31	0.31	0.31	0.15	0.5	0.5	0.5	0.5	0.5
Total price (L.E/Kg)	2.0	5.72				11.84						
Milk price (L.E/0.25Kg)	2.5											
Yogurt price (L.E/0.25Kg)	3.0											
Yogurt price L.E/Kg	12.0											
Total price (L.E/Kg)												
C1	1000x8.5÷130=65.38											
T1	1.0+(0.5+0.31+0.31+0.31)+2.5= 4.93											
T2	1.0+(0.5+0.31+0.31+0.31)+3.0= 5.43											
C2	65.381000x8.5÷130=											
T3	1.0+(0.15+0.31+0.5+0.5+0.5+0.5+0.5)+2.5=6.46											
T4	1.0+(0.15+0.31+0.5+0.5+0.5+0.5+0.5)+3.0=6.96											
Total price (L.E/130gm)												
C1	8.5											
T1	4.93÷1000x130=0.64											
T2	5.43÷1000x130=0.71											
C2	8.5											
T3	6.46÷1000x130=0.84											
T4	6.96÷1000x130=0.90											

Br =Barley, A= Apple, Bb= Black berries, G= Guava, B= Banana, OC= Orange Carrot, YSp= Yellow Sweet potato, Be= Beet, S= Spinach, Ce= Celery, Ch= Chives, P= Parsley, C1= fruits commercial food, T1= camels' milk for fortified barley and fruits, T2= yogurt camel milk for fortified barley and fruits, C2= vegetables commercial food, T3= camels' milk for fortified barley and vegetables, T4= yogurt for fortified barley and vegetables

CONCLUSION

In conclusion, children food have been blended of barley, fruits and vegetable and their nutritive and sensory evaluation have been improved upon by camels' milk and fermented camels' milk. And addition to, it were meet the requirements for children food after weaning in terms of the protein, carbohydrates, fats, minerals and vitamins. Barley, a rich source of common and unique antioxidants, is a very convenient way to increase average daily antioxidant intake. And increase the nutritional importance of this with the addition of fruits and vegetables in addition to fermented and non-fermented camels' milk. Which have an impact on children's health is useful after weaning.

From this it follows that the prefers children food non-fermented camels' milk for fortified barley and vegetables manufacturing after weaning While it may be children food fermented camels' milk for fortified barley and fruits. The recommended to intake of fermented and non-fermented camels' milk fortified barley, fruits and vegetables, due to a high level of antioxidants in the body is possible when there is regular, high consumption.

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إنتاج غذاء غير تقليدي للأطفال بعد الفطام

تامر توفيق السيسي[1], مروة حاتم الجندي[2] وسعاد احمد علي[3]

[1]- المركز الإقليمي للأغذية والأعلاف، مركز البحوث الزراعة.

[2]- شعبة الانتاج الحيواني والدواجن، مركز بحوث الصحراء، القاهرة، مصر.

[3]- مستشفيات جامعة القاهرة، القصر العينى، القاهرة، مصر

هدفت هذه الدراسة إلى تصنيع منتج غذائي للأطفال بعد سن الفطام من لبن الإبل والزبادي المصنع منه والمدعمه بالشعير والعديد من الفواكه والخضروات. وقد اجرى عليها العديد من الاختبارات التكنواوجية المختلفة، من الخصائص الفيزيائية والكيميائية والميكروبيولوجية والفنية والحسية. وقد اظهرت النتائج ان التركيب الكيميائى للأغذيه الاطفال المصنوعه من لبن الابل المتخمر والغير متخمر المدعم بالشعير والفاكهه والخضروات كانت معنويه ($p\leq0.05$). وقد كان اجمالى المتبقى الحى للعينات أعلى بسبب ارتفاع المواد الصلبة. أيضا، كانت لزوجة لبن الإبل المخمر أفضل من حليب الإبل غير المخمرة. وكانت اغذية الاطفال المصنوعه من لبن الابل المتخمر والمدعمة بالشعير والخضروات والفاكهه الاعلى فى مستوى مضادات الاكسدة. وأظهر التقييم الحسي للأغذية الأطفال أن لبن الإبل المخمر المدعم بالشعير والفواكه أفضل من القبول العام من المظهر، ولون الجسم، والملمس والنكهة من لبن الإبل غير المتخمرة المدعم بالشعير والفواكه. في المقابل، ان لبن الإبل المتخمر المدعمه بالشعير والخضروات أقل من تلك المصنوعة من لبن غيرالمتخمر. وأظهر التقييم الاقتصادي للأغذية الأطفال المصنعه من لبن الإبل (المتخمر وغير المتخمرة) أرخص من أغذية الأطفال التجارية. وأخيرا، في حالة تصنيع أغذية للأطفال بعد سن الفطام من لبن الإبل غير المتخمر والمدعم بالشعير يفضل ان يكون مخلوط بالخضروات، في حين أنه فى حاله لبن الابل المتخمر يفضل ان يمزج مع الفاكهة.