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Yoghurt Fortified with Cooked Rice as an Especial Function Food

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ABSTRACT

The objective of this study was to apply rice as a partial milk substitute to produce low protein yoghurt-like suitable for children suffered from some diseases such as inborn errors of protein metabolism, renal failure and hepatic affection.Rice was soaked in water at a ratio of 1:10, and then boiled for 30 min. The cooked rice was blended in its cooking water and used for yoghurt milk fortification at levels of nil, 60 (T1), 70 (T2) and 80% (T3).All mixed milk were heat treated at 85°C for 10 minandthen cold to 42ºC, at which they were inoculated with 2% yoghurt bacterial starter culture and incubated at the them temperature. After complete coagulation, all treatments were stored at 4±1ºC for 15 days and examined when fresh and after 1and 2 weeks of cold storage. Results revealed that the highest sensory score was obtained in yoghurt made by replacement with homogenized cooked rice. The results showed that milk with 80% homogenized cooked rice (T3) attained the least concentration of amino acids, total protein, ash, and fat with highest content of carbohydrates. The percentage of total solids and total carbohydrate reached the highest level while ash, fat and protein level decreased with using the highest concentration of cooked rice.Lactose content was least in T3 (0.703 mg %) compared to 1.232 mg% and 1.685 mg% in T2 and T1, respectively. This makes T3 suitable for consumption in cases with lactose intolerance. The syneresis of yoghurt was significantly affected ($P<0.5$) by the concentration of homogenized cooked rice used. Adding homogenized cooked rice to yoghurt making was accompanied by high level of iron due to the double contents of this element in rice. Results also indicated that substitution by 60, 70 and 80 % homogenized cooked rice led to significant decrease in hardness, adhesiveness, gumminess and chewiness while cohesiveness and springiness increased in fresh yogurt and during storage.The results suggested that rice-based yoghurt may be used for managing children affected by inborn errors of amino acids metabolisms and lactose intolerance as well.
Keywords: Food-inborn errors of protein -Lactose intolerance –Galagtosemia

INTRODUCTION

Conventional yoghurt is defined as a coagulated milk product from the fermentation of lactic acid in milk by *Lactobacillus delbrueckii* ssp. *bulgaricus* and *Streptococcus thermophilus* (CODEX STAN 243,2002). These strains must be resistant to bile salts being present in the lower intestine, low (pH 1-4), enzyme present in the intestine (lysozyme) and toxic metabolites resulted in during digestion (Hoier,1992). Bacterial species used in making the traditional yoghurt, *Lactobacillus delbrueckii* ssp. *bulgaricus* and *Streptococcus thermophilus* do not belong to the indigenous intestinal flora. They are not bile acid resistant and cannot survive passage through the gut (Gilliland, 1979 and Fayed *et al.* 2011a and b).

Yoghurt and other dairy products can contribute pronounced amounts of cholesterol and saturated fat to the diet. An increase of the risk of heart disease and other serious health problems might be due to the consumption of diets high in fat and, especially, in saturated fat (Harrington and Mayberry, 2008). An increase of the demand to develop alternative product(s) to cow milk due to problems with allergenicity, lactose intolerance, protein metabolic disorders and desire for vegetarian alternatives.Lactose intolerance is also very common in people of westAfrican, Arabic, Jewish, Greek, and Italian descent (Lomer*et al*., 20

Lactose is normally broken down by lactase to glucose and galactose, by cells in the lining of the small intestine. Congenital lactase deficiency (alactasia) is a disorder in which infants are unable to break down lactose in breast milk or infant formula, resulting in severe diarrhea and severe dehydration (He *et al*., 2008).

Phenylalanine (Phe), on the other hand, is an indispensable amino acid being converted to tyrosine (Tyr) by the enzyme phenylalanine hydroxylase (PAH; EC 1.14.16.1) in the individual with normal metabolism. Absence or impaired function of this enzyme results in metabolic disorder phenylketonuria (PKU). If the diet of an individual with PKU is not modified throughout the first 20 days of life, Phe and its breakdown products accumulation may lead to severe dehydration in the blood and brain, resulting in neurological damage and mental retardation. Other inborn errors of protein metabolisms also to be dealt with an emergency include maple syrup urine disease (MSUD) (Scriver, 2000).

Bernat*et al*., (2015) stated that vegetable “milk” is currently at the forefront due to the growing problems related with intolerance or to changes in food preferences (Bernat*et al*., 2015). Yoghurt like products have been produced with the addition of cereals such as liquefied starch; prefermented and extruded rice flour and cooked maize meal mixture (Mok*et al*., 1991).

Rice is rich in nutrients, vitamins and minerals, being considered as an excellent source of complex carbohydrates. Nine out of every ten people in the world who eat rice are Asian. Rice flour characterized with the absence of gluten, low levels of sodium, protein, fat and fiber, and high amount of easily digested carbohydrates, which are desirable for certain special diets (Gujral*et al*. 2004).

Those people with lactose intolerance are advised to drink rice milk, since it is cholesterol free with unsaturated fat. The milk enhances immune system and provides resistances to bacteria and viruses invading the body due to high content of selenium and magnesium (Adewale*et al*., 2016).

Therefore, the objective of this study was to apply rice as a partial milk substitute to produce low protein yoghurt-like suitable for children suffered from some diseases such as inborn errors of protein metabolism, renal failure and hepatic affection.

MATERIALS AND METHODS

Fresh buffalo's milk used in this study was obtained from Sakha Experimental Station,Agriculture Research Center, Ministry of Agriculture, Dokki, Egypt. Rice (variety Giza 177) was obtained from Field Crops Institute, Agriculture Research Center, Giza, Egypt. The starter culture which contains mixed strains of *Lactobacillus delbrueckii* ssp. *bulgaricus*and *Streptococcusthermophilus* was obtained from Hansen's Laboratories, Denmark. The compositions of milk and rice are shown in Table (1).

Table (1):Proximate chemical composition (%) of rice and milk

Raw material	Moisture	Ash	Protein	Fat	Carbohydrate (by difference)
Rice	11.555	0.313	7.953	0.735	79.444
Milk	85.123	0.670	4.433	5.5	4.274

Yoghurt was manufactured according to the method of Tamime and Robinson (1985). Rice was soaked in water at a ratio of 1:10, and then boiled for 30 min. The cooked rice was blended in its cooking water and used for standardizedyoghurt milk (3% fat) fortification at levels of nil, 60, 70 and 80%. All mixed milk were heat treated at 85°C for 10 minthen cold to 42ºC, at which they were inoculated with 2% yoghurt bacterial starter culture,dispersed into plastic cups 200 g for each and incubated at the them temperature. After complete coagulationwhen pH reached ~ 4.7, (within ~ 4h.), all treatments were stored at 4±1ºC for 15 days and examined when fresh and after 1and 2 weeks of cold storage.

The proximate composition of yoghurt samples was determined according to the method of AOAC (2007), while the lactose content was assessed using the method of Dubois*et al.*, (1956). Fat and titratable acidity of different yoghurt samples were determined according to Mistry and Hassan (1992), while the pH values was measured using a pH meter (Model SA 720, Orion, USA).Amino acid analysis was performed an amino acid analyzer (Model LC 3000, Pharmacia-Amercham, Switherland). The major and minor mineral elements were determined using Atomic Absorption Spectrophotometer (Model 3300, Perkin-Elimer, Beaconsfield, UK) according to the method of Morr and Foegeding (1990).

The chromatographic determination of sugars was carried out on HPLC

Hewlett Packard series 1050, with RI detector, according to the method of Zielinski, *et al.* (2014).Carbohydrate were extracted from different yoghurt samples and prepared for injection into HPLC. The analysis was carried out using Aminex carbohydrates HPX-87c (300mmx78mm) at 85°C, with deionised water as mobile phase. The flow rate was kept at o.8ml/min and 75µl of the sample was injected. Quantitative determination was based on peak area measurement while qualitative identification was carried out by comparison of the retention times of the peaks with those of the authentic sugars through the data analysis of HewlletPackared software.

Syneresis (whey separation) was determined by measuring the volume of separated whey (ml whey/100ml yoghurt) collected after 30min at room temperature (Abd-El-Salam *et al.,* 1991).

Texture profile analysis of different yoghurt samples was performed using a Texture Analyzer (a Universal Testing Machine, TMS-Pro, Food Technology Corporation, Sterling, Verginia, USA).

The samples were compressed to 30% of their original height by a flat-rod probe (49.95mm in diameter). Each sample was subjected to two subsequent cycles (bites) of compression-decompression.From the texture profile analysis curve, the hardness, cohesiveness, springiness, gumminess, chewiness and adhesiveness were calculated by texture analyzer software (program DEV TPA, texture Technologies Corp.) as described by Szczesniak*et.al.* (1963) and Bourne (1978).

The viable cell counts of lactic acid bacteria were estimated using the standard plate count method (Elliker*et al.*, 1956) Coliforms were enumerated according to the method of Harrigan and McCance (1996) using Violt Red bile agar media. Mold and yeast were determined according to Standard Methods for Examination of Dairy Products (APHA,1992).The number of colony forming unit (CFU) after incubation are expressed as log cfu/ml.

A total of 10 panelists of staff members at Dairy Manufacturing Technology Research Department, (Food Technology Research Institute, Agriculture Research Center, Giza, Egypt), evaluated the sensory quality of rice-based yoghurt fermented with a mixed starter culture on day 1 after production. The products were evaluated for flavor (30 score), body and texture (40 score), appearance (20 score), Sourness (10 score) and overall acceptability (100 score) according to the method of Nelsons and Trout (1981). The sourness was evaluated as extremely weak (1) to extremely strong (10). The body and texture was evaluated as sandy (1) to smooth (40). The appearance, flavor or overall acceptability was evaluated as dislike extremely (1) to like extremely (20, 30 or 100, respectively).

The results obtained were subjected to analysis of variances using general linear models procedures of SAS systems (SAS Institute Inc. 1990). Differences among means were compared using Duncans'Multiple

Range Test. All statistical analyses were considered significantly different at the P<0.05.

RESULTS AND DISCUSSION

Sensory properties It is evident from the results of judgingscoresof yoghurt-like samples given in Table (2) that the addition of different levels of blended cooked rice led to significant effects onthe appearance, flavor, sourness and body&texture of the product. As the concentration of blended cooked rice increased up to 60%, all organoleptic criteria of the productgained significantly higher scores. Whilethe samples gained lower scoreswhen the fortification level exceeded to 80% or more.

These phenomena agree with those found by Plug and Haring (1993) and Ohmes *et al*.(1998) who declared that, the differences those found in the scores of samples made with blended cooked rice cold be expected asthe main carrier of flavor for many compounds. Moreover, Blomsma(1997) reported that, the rice substituting elevated the product's ability to stabilize water into creamy structure, which has an excellent mouth feel.

According to the results of the primary sensory evaluation the following study was designed for yoghurt fortified with the cooked rice at levels of 60, 70 and 80%.

Results in Table (3) reveal that the total solids and total carbohydrate contents reached the highest level while ash, fat and protein percentage as well as energy decreased along with using the highest concentration of rice.

Table (4) shows that control treatment gave highest titratable acidity value compared with treatments 60%,70% and 80% replacement with blended cooked rice. This was reported by Renner (1986)and Rasic&Kurmann(1978) that the main source of energy for lactic acid bacteria is lactose originally present in control in high concentration than treatments.

The syneresis of yoghurt was significantly affected (P<0.05) by the concentration of blended cooked rice used as shown in Table (4). Decreased separation of whey from yoghurt was observed in the highest level of cooked rice used, which may be due to the higher added rice content. Similar results were reported by Cerning*et al*., (1990) who mentioned that the exopolysaccharides reduced syneresis when used in yoghurt.

Table (2): Sensory scores of fresh yoghurt as affected by the level of cooked rice added

Property	**Level of cooked rice**					
	0% (Control)	**20%**	**40%**	**60%**	**80%**	**100%**
Appearance (20)	20^{a} ±0.5	20^{a} ±0.00	19^{b}±0.94	18.6^{c}±3.54	18.5^{d}±1.41	18.25^{e}±0
Flavor (30)	25.5^{b}±0.6	25.75^{a}±0.84	25.75^{a}±0.82	23.75^{d}±2.15	21.25^{e}±0	16.6^{g}±3.56
Sourness (10)	9^{a} ±0.76	8.75^{a} ±0.85	8.5^{b}±0.35	8.00^{c}±0.73	6.25^{e}±0.67	5.75^{g}±0.82
Body&Texture(40)	36.5^{b} ±3.5	37.3^{a} ±2.35	36^{c}±2.12	35.25^{d}±0.95	25^{f}±4.3	17^{h}±2.15
Total score (100)	91^{b} ±7.9	91.5^{a} ±7.9	89^{c}±7.32	85.5^{d}±8.09	70.75^{g}±10.22	57.5^{h}±8.8

Values within row with different superscript letters are statistically significant (P<0.05).

Table (3): Chemical composition of fresh yoghurt as affected by the level of cooked rice added

Property	**Level of cooked rice**		
	60% (T1)	**70% (T2)**	**80% (T3)**
Moisture %	88.84^{c} ±0.1	88.88^{b}±0.15	89.51^{a}±0.2
Ash %	0.494^{a}±0.16	0.435^{b} ±0.3	0.358^{c}±0.25
Protein %	2.360^{a}±0.12	2.155^{b}±0.35	1.566^{c}±0.23
Fat %	1.40^{a}±0.2	1.20^{b}±0.4	1.00^{c}±0.18
Total Carbohydrate %	6.906^{c}±0.15	7.330^{b}±0.3	7.566^{a}±0.1
EnergyKcal/100gm weight	51.64^{a}±0.5	50.49^{b}±0.2	46.96^{c}±0.14

Table (4): Physiochemical properties of fresh yoghurt as affected by the level of cooked rice added

Property	**Level of cooked rice**		
	60% (T1)	**70% (T2)**	**80% (T3)**
pH value	4.4^{c}±0.014	4.5^{b}±0.01	4.6^{a}±0.02
Acidity (%)	0.98^{a}±0.02	0.94^{b}±0.015	0.9^{c}±0.04
Syneriss (ml/100g)	30^{a}±0.03	20^{b}±0.1	6^{c}±0.08

See table (1)

Results in Tables (3 and 4)show that all of the amino acids in Table (5), total protein, ash and fat (gm/100g) were found to be lower in the treatment T3 (milk with 80% rice) as compared to T1 (milk with 60% rice) and T2 (milk with 70% rice). On the other hand, carbohydrates content were highest in T3 compared to T1 and T2 treatments. In a study on the etiology of mental retardation in Egypt, the inborn errors of amino acids metabolism constitute up to (11.5%) of all of the metabolic causes . Inborn errors of protein metabolism lead to mental retardation and other developmental disabilities if untreated in infancy. It was reported that, one in every 32 individuals carries a gene for IEM (Shawky*et al*., 2012). In the same study on the etiology of mental retardation in Egypt, genetic causes represented 54.4%, of which the metabolic causes represented 19.9%, with inborn errors of amino acids constituting up to (11.5%).

Testing for the phenylketonuria (PKU; an autosomal recessive disease) should be done when the infant is at least twenty-four hours of age to early detect those diseased infants (Hashem, 1978; Temtamy, 1998 and Su, *et al*., 2009). Infants who are severing from hyperphenylalaninemia or with PKU will be in big dilemma. There is a need for more amount of milk formula for patients with PKU. Milk formula have proven to be highly effective in preventing mental retardation (Benson *et al.*, 1998 and Shawky*et. al.*, 2000) and Shawky *et. al.*, (2000). Affected children cannot consume meat, milk, or other foods that contain protein. Instead, they must eat specially manufactured food free from phenylalanine. Fruits, vegetables, and certain grain cereals, can be eaten. Higher dosage of the protein substitute appeared to contribute to lower blood phenylalanine (Shawky*et al*., 2001 and Darling *et al.*, 2004). Maple syrup urine disease (MSUD), patients have deficiency of the enzyme involved in the common metabolic pathways of the essential branched-chain amino acids leucine, Isoleucine, and valine . (Rimoin*et al*., 2001 and Food and Nutrition Board, Institute of Medicine 2002), low-protein diet in addition to the medical management (Benson and Fensom, 1985)

Table (5): Amino acids composition (g/100g)of yoghurt as affected by the level of cooked rice added

Amino acid (%)	Level of cooked rice 60% (T1)	70% (T2)	80% (T3)
Aspartic (ASP)	0.17	0.15	0.13
Therionine (THR)	0.09	0.08	0.07
Serine (SER)	0.11	0.95	0.08
Glutamic(GLU)	0.64	0.55	0.49
Proline(PRO)	0.19	0.16	0.14
Glycine (GLY)	0.05	0.044	0.04
Alanine (ALA)	0.08	0.07	0.07
Valine (VAL)	0.20	0.17	0.15
Isoleucine(ILE)	0.11	0.10	0.09
Leucine(LEU)	0.30	0.26	0.22
Tyrosine(TYR)	0.12	0.11	0.09
Phenylalanine(PHE)	0.11	0.09	0.08
Histidine(HIS)	0.07	0.06	0.05
Lysine(LYS)	0.16	0.13	0.11
Argnine (ARG)	0.08	0.075	0.07

Table (6) shows that lactose content was least in T3 (0.703 mg %) compared to 1.232 mg% and 1.685 mg% in T2 and T1 respectively. This makes T3 suitable for consumption in cases with lactose intolerance. Lactose intolerance is inherited in an autosomal recessive pattern (Itan*et al*., 2010) and Järvelä, (2005). Symptoms of a milk allergy reaction varied from mild, such as hives, to severe, such as anaphylaxis. The allergy is most likely to persist in children who have high levels of cow's milk antibodies in their blood (Holton *et. al*.,2001 and Bosch 2006).The most troubling problem is that many patients suffering from long-term complications, such as reduced cognitive ability, language impairment, decreased bone mass, and hypergonadotrophic hypogonadism in women (Kaufman *et al*., 1981; Waggoner *et al*., 1990; Schweitzer *et al*., 1993; Panis *et al.* 2004; Potter *et al.* 2008 andSchadewaldt*et al*. 2010).

Partially replacement of milk with blended cooked rice to prepare yoghurtwas accompanied by high level of Iron due to the double contents of this element in rice (Table, 7). The calcium contents were129.69, 97.31and 64.92 mg/100g for yoghurt treatments, respectively. Studies indicated that intake of calcium rich food during childhood and adolescence is important determinant of peak bone mass and future risk of osteoporosis (Kohlmeier, 2003). Consuming 100g of this rice-based yoghurt gives about 16.21, 12.16 % and 8.12% of the Recommended Dietary Allowance (RDA). Partially replacement milk with blended cooked rice increase the Fe content of the yoghurt as it is considered poor sources of Iron (Abd El- Salam *et al.*, (2004), Rao, (1982) and Shawky*et. al*., (2003).

Table (6): HPLC analysis for Saccharides (%)of yoghurt as affected by the level of cooked rice added

Saccharide %	Level of cooked rice 60% (T1)	70% (T2)	80% (T3)
Inulin	3.510	3.742	2.3144
Glucuronic	0.000	0.704	0.235
Stachyose	0.000	0.056	0.047
Galacturonic	0.039	0.016	0.014
Lactose	1.685	1.232	0.703
Lactelose	0.024	0.000	0.002
Glucose	0.046	0.004	0.004
Rhaminose	0.218	0.000	0.000
Galactose	0.000	0.123	0.023
Arabinose	0.000	0.003	0.003
Fructose	0.010	0.002	0.001
Manitol	0.000	0.001	0.002
Sorbitol	0.001	0.0003	0.003

Table (7): Minerals contentof yoghurt as affected by the level of cooked rice added

Mineral	Means RDA* /(mg)	Level of cooked rice 60% (T1)		70% (T2)		80% (T3)	
		mg/100g	% from RDA	mg/100g	% from RDA	mg/100g	% from RDA
Ca	800.0	129.69	16.21	97.31	12.16	64.92	8.12
K	1550.0	45.29	2.92	34.70	2.24	24.12	1.56
Fe	10.00	0.52	5.2	0.44	4.4	0.36	3.6
Mg	200.0	34.72	17.36	26.59	13.29	18.46	9.23
Zn	5.00	1.04	20.78	0.85	16.91	0.65	13.04
Na	1200	12.36	1.03	9.82	0.82	7.28	0.61

- **RDA = Recommended Dietary Allowance by WHO/FAO 2000**

Lumbert*et al*., (2001) Zinc is considered to be of antiapoptotic properties. It inhibits the events of apoptotic pathways-dependent endonuclease cleavage of chromatin DNA, poly-ADP ribose polymerase cleavage, and caspase-3 activity.

Rheology can be used as quality control tool in processing, as it has been closely correlated with the overall texture, sensory attributes of the food products and microstructure changes during processing. The changes in texture profile analysis (TPA) of yoghurt made from milkpartially replacement with blended cooked rice in fresh and during storage periods for 7 and 14 days at 4±1ºc are shown in Table (8).Results indicated that substitution by 60, 70 and 80 % blended cooked rice led to significant decrease in hardness, adhesiveness, gumminess and chewiness while cohesiveness and springiness increased in fresh yogurt. This may occur because starch has a high water-holding and binding capacity, causing high moisture retention and lower protein. This may have contributed to decrease in the cross-linking of casein matrix (Zisu, 2005). At the end of storage periods, hardness, cohesiveness, gumminess and chewiness values decreased in all treatments but adhesiveness and springiness values increased during storage period. The hardness, adhesiveness, cohesiveness, springiness, gumminess and chewiness values were affected by storage period in all treatments. Molander*et al.*, (1990) found that the texture profile analysis value correlated well with the sensory evaluation, the firmness, the age, pH and proteolytic

Table (8): Texture profile analysisof yoghurt as affected by the level of cooked rice added

Property	Level of cooked rice	Storage period Fresh	1 week	2 weeks
Hardness (g)	60% (T1)	1.8	1.2	1.0
	70% (T2)	1.2	0.9	0.7
	80% (T3)	0.4	0.4	0.3
	Mean±SD	1.1±0.670	0.8±0.309	0.7±0.446
Adhesiveness (g/sec.)	60% (T1)	1.181	2.508	2.795
	70% (T2)	0.510	1.819	2.039
	80% (T3)	0.109	1.528	1.880
	Mean±SD	0.6±0.542	2.047±0.663	2.2±0.167
Cohesiveness (~)	60% (T1)	0.55	0.63	0.21
	70% (T2)	0.62	0.82	0.31
	80% (T3)	0.79	0.90	0.56
	Mean±SD	0.65±0.127	0.78±0.141	0.36±0.182
Springiness (mm)	60% (T1)	5.85	18.24	18.39
	70% (T2)	8.69	18.34	18.40
	80% (T3)	10.2	18.39	18.40
	Mean±SD	8.23±2.23	18.32±0.0758	18.40±0.0033
Gumminess (g)	60% (T1)	1.1	0.8	0.4
	70% (T2)	0.6	0.6	0.2
	80% (T3)	0.4	0.4	0.2
	Mean±SD	0.7±0.374	0.6±0.228	0.2±0.119
Chewiness (g/mm)	60% (T1)	20.12	15.63	3.74
	70% (T2)	11.84	10.26	1.34
	80% (T3)	6.50	7.39	0.97
	Mean±SD	12.82±6.86	11.09±4.19	2.02±1.51

Table (9): Lactic acid bacteria, coliform, mold and yeast counts (log cfu/ml) of yoghurtas affected by the level of cooked rice added.

Type of organism	Storage period (day)	Level of cooked rice		
		60% (T1)	**70% (T2)**	**80% (T3)**
Lactic acid bacteria	Fresh	8.5	8.1	7.3
	5	8.2	7.6	6.5
	10	7.5	7.0	5.9
	15	6.3	6.1	5.4
Coliform	Fresh	N.D	N.D	N.D
	5	N.D	N.D	N.D
	10	N.D	N.D	N.D
	15	N.D	N.D	N.D
Mold and yeast	Fresh	N.D	N.D	N.D
	5	N.D	N.D	N.D
	10	N.D	N.D	N.D
	15	N.D	N.D	N.D

N.D.=Not detected.

The changes of viable count of lactic acid bacteria during storage period are presented in Table (9). Data indicated that the viability remained higher for 5 days of cold storage and then started to decline. The results indicated also that, the count of lactic acid bacteriawas higher in yoghurt with lower concentration of blended cooked ricedue to lower concentration of lactose.As a result of high hygienic conditions during manufacturing and storage, molds and yeasts and coliform bacteria were not detectable in all treatments when fresh and throughout storage period. These results are in agreement with those reported by Hareedy*et al.*, (2008).

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اليوجهورت المدعم بالأرز المطبوخ كغذاء وظيفى خاص

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تهدف هذه الدراسة إلى أستخدام الأرز كبديل جزئى للبن لإنتاج منتج متخمر منخفض البروتين مناسب للأطفال المولودين بعيوب خلقية وراثية فى استقلاب البروتين ، والأشخاص الذى يعانون من الفشل الكلوى وأمراض الكبد .حيث تم نقع الأرز فى الماء بنسبة ١:١٠ (نسبة الأرز إلى الماء) ومن ثم الغلى لمدة ٣٠ دقيقه ثم مزج الأرز المطبوخ فى ماء الطهى وتم استبدال اللبن الحليب بنسب صفر% (الكنترول) ،٦٠% المعامله(T1) , ٧٠% فى (T2) و٨٠% فى المعامله (T3) . ثم تمت معامله حرارية للمخلوط على ٨٥°م لمدة ١٠ دقائق يتبعها التبريد ثم التدفئه ل٤٢°م ، ثم التلقيح ببادىء الزبادى بنسبة ٢% والتحضين على ٤٢°م حتى الوصول إلى التختر الكامل، تم تخزين كل المعاملات على ٤±١°م لمدة ١٥ يوم وفحصها طازجة وبعد ١،٢ أسبوع من التخزين البارد.وكشفت النتائج أن أعلى درجة الحسية تم الحصول عليها في المعامله التى تم استبدال اللبن فيها مع الأرز المطبوخ المتجانس. وأظهرت النتائج أن الحليب مع ٨٠٪ من الأرز المطبوخ المتجانس *(T3)* حققت أقل تركيز من الأحماض الأمينية والبروتين الكلي والرماد والدهون مع أعلى نسبة من الكربوهيدرات. و بلغت نسبة المواد الصلبة الكلية وإجمالي الكربوهيدرات فى أعلى مستوى في حين إنخفض الرماد والدهن ومستوى البروتين باستخدام أعلى نسبة من الأرز المطبوخ كما أن نسبة الاكتوز كانت الأقل في المعامله (*T3*) حيث حققت ٠.٧٠٣% مقارنة مع ١.٢٣٢ ٪ و ١.٦٨٥٪ في *T2* و*T1* ، على التوالي. وهذا يجعل *T3* صالحة للاستهلاك في حالات عدم تحمل اللاكتوز. تأثر أستبدال اللبن معنويا ($P < 0.5$) من خلال تركيز الأرز المطبوخ المتجانس المستخدمة. بالأضاف إلى زيادة نسبة استخدام الأرز المطبوخ كان مصاحب له ارتفاع مستوى الحديد بسبب محتويات مضاعفة من هذا العنصر في الأرز. كما أشارت النتائج إلى أن الاستبدال بنسبة ٦٠ و ٧٠ و ٨٠٪ من متجانس الأرز المطبوخ أدى إلى انخفاض كبير في صلابة، الإلتصاق، اللزوجة و*cohesiveness* في حين زاد تماسك ومرونة في اللبن الطازج وأثناء التخزين. وأشارت النتائج إلى أن الزبادي المرتكزة على الأرز يمكن أن يستخدم للأطفال المصابين بخلل فى أيض الأحماض الأمينية وعدم تحمل الاكتوز أيض