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Making of Low Calorie Functional Yoghurt Drink Enriched with Oat Seed and Stevia Leaves Powders (as Sweeteners)

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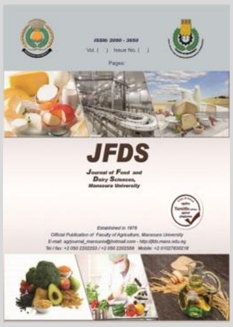

ABSTRACT

Functional yoghurt drinks (Y.D) were prepared as follows : treatment A (Y.D. + 3% oat + 6% sucrose) , treatment B (Y.D. + 3% oat +0.25 % stevia) , treatment C (Y.D. + 6% sucrose , control) .All drinks were stored at 5 ± 1 °C for 15 days and analyzed for chemical , microbiological , rheological , and sensory properties . Total energy , total solids (T.S) , fat , total protein , carbohydrate and ash contents were found highest in treatment A , during storage period .Treatment A recorded the highest values of viscosity and the lowest rate of whey separation . Total dietary fibers was found higher in fresh treatment B **.** Seven essential amino acids (EAA) and ten Non-essential amino acids (NEAA) were detected in all fresh Y.D samples . Valine amino acid was the predominant amino acid in EAA and Glutamic acid was the corresponding one in NEAA. Sulfur amino acids (Methionine & cysteine) were also detected in all treatments. The ratio between EAA **:** NEAA was found highest in Y.D A , followed by B and C , in order **.** Counts of lactic acid bacteria in yoghurt drinks fortified with oat were found the highest . Yeasts & Molds were appeared in low counts in all treatments at the day 15 of storage . Therefore , low calorie functional Y.D. sweetened with stevia and fortified with oat powder may be produced successfully

Keywords **:** yoghurt , permeate , oat , stevia and sucrose

INTRODUCTION

Yoghurt drink is categorized as stirred yoghurt of low viscosity. Milk, in general, could either be used alone or with the addition of other food additives as for example soy-bean flour, whey: butter milk permeate, cassava starch, dried milk at different concentrations. A wide range of mixed cultures have been used in making yoghurt. Whey separation may be a problem and its necessary to incorporate stabilizer into the milk base.Yoghurt and its related products are highly nutritious and easily digestible as it is rich sources of certain essentials nutrients in particular, certain minerals and vitamins. Fermented beverages generally as they were considered as suitable beverage for human nutrition, and of refreshment effect. The beverages could also be of health benefits as probiotic drinks (Tamime&Robinson, 2007, Weerathilake ,2014, and Nursiwi *et al*., 2017)

Stevia rebaudiana bertoni is a herbaceous perennial, known as sweet weed, leaf, herb and honey leaf. Eight different sweet glycosides, with stevioside and rebaudioside A having been used commercially in some parts of the world for many years. Rebaudioside A is non-caloric, zero carbohydrate, natural sweetener , widely distributed as a sweetener or flavour enhancer in USA and many other countries. 200-300 times higher the natural stevia is sweetener than sucrose as mentioned in it. The sweet taste sensation of stevia is derived from some glycosides, namely dulcoside A, rebaudioside A having been commercially marketed worldwide, steviolbioside, and stevioside were reported as another constituents present in Stevia, which also cntain Ascorbic acid, B- carotene, chromium, cobalt, magnesium, iron, potassium, phosphorous, riboflavin, thiamin, tin, zinc, and so forth were also detected in Stevia (Gardana*et al.,*2003, Massoud and Amin (2005, Ahmed *et al*., 2007 and Sharma *et al.* (2006)

Cereals contribute over 60 % of the world food production providing dietary fiber, proteins , energy , minerals and vitamins required for human health . The possible applications of Cereals could be used in functional foods as fermentable substrates, dietary fiber, as prebiotic, and as encapsulated materials. Oats are of high nutritional value as a a good source of antioxidant vitamin E (tocols), phytic acid, phenolic acid, avenantramids, and is are of anexcellent source of different B- glucan, arabinoxylans and cellulose. Relatively high levels of protein, lipids, vitamins, antioxidants, phenolic compounds and minerals were also found in oats. Its fiber can improve the body and texture of food products through the thickening effect of the soluble fibers. Consumption of oat resulted in slower digestion and an extended sensation of fullness. Oats could also help improve the defenses of the immune system, rduce the risk of 2 diabetes, control the blood pressure and lower bad cholesterol (Hussein, 2011, Winietal. 2014 and Khalil&Blassy , 2017)., the power of oats to improve human health may be listed in the following points:

MATERIALS AND METHODS

Fresh skimmed cow milk and permeate were obtained from Animal Production Research Institute, Agriculture Research Center, Egypt. Skimmed cow milk is of 8.50 % total solids, 3.30% protein, 0.15 % fat, 0.76 % ash, 5.08 % lactose, 0.16 % titratable acidity and 6.61 pH value, while permeate is of T.S 5.53 % , acidity 0.06 % and pH6.48).Yoghurt starter culture containing *Streptococcus thermophilus'* and *lactobacillus delbrueckii ssp. bulgaricus*

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was obtained from Cairo MIRCEN Culture Collection Center, Faculty of Agriculture, Ain Shams University, Egypt. MRS and potato dextrose agar media were bought from Oxide Division of Oxide LTD., London. Whole oat grain (total carbohydrates 65 % , protein 16 % , fat 4 % , dietary fibers 11.88 % and ash 3.02 %) and sugar (sucrose) were bought from the local market Egypt and sodium carboxymethyl cellulose (CMC) stabilizer was obtained from Misr Food Additives (MIFAD). Stevial eaves powder was bought from the local market , under the name of uni Stevia (zero calories , bitterness and artificial ingredients) and each sachet contains , steviol glycoside from (Stevia rebaudiana leaves) and maltodextrin 50 % .It Produced by Premier Int. Pharmaceutical Factory , Industrial Area , New Cairo , Egypt .

A - Preliminary pilot experiments were carried out to choose , organoleptically , the ample ratio of sugar (4 , 6 and 8 %) or stevia powder (0.1 - 0.5 g. / 100 g) to be added to (Y.D.). Results revealed that the best ratio of sugar was 6% either containing oat powder or not (treatments A &C), while the prefered ratio of stevia leaves powder obtained was 0.25 %.

Another experiment was done to choose the suitable concentration of CMC stabilizer, using range of 0.4 to 0.8%. Results showed that the appropriate concentration was 0.6 %

Skim milk yoghurt was made according to Tamime& Robinson (2007). Permeate was heat-treated at 75 °C / 5 sec.then cooled to 45 °C . The ample ratio (3%) of oat powder used was recommended by (Khalil &Blassy (2017), whereas 0.6% CMC was employed . Drink yoghurt was prepared by mixing skim milk yoghurt with permeate (70 yoghurt : 30 permeate), 3% oat powder and 0.6 %CMC were then added .The best ratio of Stevia leaves powder or sugar was added to the resultant yoghurts as follows :

Control (C): yoghurt + permeate (70 : 30) + 0.6 % CMC + 6 % sucrose .

Treatment B : yoghurt + permeate (70 : 30) + 3 % oat powder + 0.6 % CMC + 0.25 % stevia powder

Treatment A : yoghurt + permeate (70 : 30) + 3 % oat powder + 0.6 % CMC + 6 % sucrose

The resultant yoghurt drinks were packed in sterilized glass bottles and kept in the refrigerator until analyzed chemically ,physically , microbiologically and organoleptically, when fresh and after 5 , 10 and 15 days of storage

Titratable acidity (T.A.), pH value (measured in triplicates using an electric pH meter with combined glass electrod, jesenway 3305, England), total fibers , total protein and total solids were determined according to theAOAC official methods (AOAC, 2012). Viscosity was determind using Brookfield viscometer, Brookfield Engineering Labs., USA equipped with spindle 5 and speed 50 rpm / min.The caloric value of the resultant yoghurt drink was calculated using the following equation given by Walstra and Jenness (1984):

$$E=370F+170P+168L+18$$

Where E=Total energy (KJ/kg). F=Fat content (%).
P=Protein content (%). L=Carbohydrate content (%).

The sensory evaluation was assessed as recommended by Nelson and Trout (1964)..Serum separation(synersis) of yoghurt drink was measured as the amount of separated whey from yoghurt drink samples during refrigerated storage. The separated upper layer of whey was collected by means of sterilized syringe, and measured using a graduated cylinder, relation to the total sample height in the bottle and expressed as the percent serum separation (Hatem , 1996) .

Amino acids composition of experimental samples were determined using HPLC-Pico-Tag method according to Millipore Cooperative (1987),as described by Heinriksonand Meredith (1984), White *et al*. (1986) and Cohen *et al*. (1987). The Phenyl isothiocyanate (PITC, or Edman's reagent) was used for precolumn derivatization, while reversed-phase gradient elution high performance liquid chromatography (HPLC) separates the phenyl thiocarbamyl (PTC) derivatives which were detected by their UV absorbance. The sample corresponding to the protein ratio was weighted into 25 × 150 mm hydrolyzed tube using 6 N HCl and placed in 110ºC oven for 24 hr, then tube was removed from the oven and allow to cool.

Counting of Lactic acid bacteria were determined using MRS agar medium by incubation at 37ºC for 48 h, and the molds and yeasts were examined by using potato dextrose agar medium, and incubation at 25°C for 72 h as recommended by the American Public Health Association (APHA, 2004).

The sensory evaluation was assessed as recommended by Nelson and Trout (1964).The samples were evaluated for appearance, body & texture and flavour out of 15, 35 and 50 score points .

RESULTS AND DISCUSSION

Total energy (kj/1g) of yoghurt drinks (Y.D) :

Results in Table (1) show that the total energy of treatment A recorded the highest values , during the storage period ,followed by treatments C and B , respectively . Treatment B scored the lowest values, and ranged between 1839.34 – 1864.70 k j / 1kg Y.D. In another mean every 100g of that drink will offer approximately 183.9 kj for the consumer. The main reason for that was the use of sugar substitute stevia (which is of a zero calories) instead of sucrose to sweeten the Y.D . The total energy of all treatments decreased in all treatments as the storage period progressed .

Table 1. Total energy (kj/1kg) of low calories yoghurt drinks

Treatments	Storage period (days)			
	Fresh	5	10	15
C	2399.84	2389.68	2394.66	2379.42
B	1864.70	1856.22	1841.04	1839.34
A	2863.38	2843.26	2841.26	2817.64

Control (C) : yoghurt + permeate (70 : 30) + 0.6 % CMC + 6 % sucrose

Treatment B: yoghurt + permeate (70: 30) + 3 % oat powder + 0.6 % CMC + 0.25%
Stevia leaves powder

Treatment A: yoghurt + permeate (70: 30) + 3 % oat powder + 0.6 % CMC +6 % sucrose. .

Chemical composition:

Data presented in Table (2) show the chemical composition of the resultant three treatments of Y.D, during the storage period. Total solids (T.S), fat, total protein, carbohydrate and ash contents were found higher in treatment A , during the storage period , compared with the control and treatment B. T.S and carbohydrate contents of treatment B (which are sucrose-free) were found of the lowest ones . Sucrose and oat powder are responsible for that variation in these parameters .As the storage period advanced, T.S, total protein and carbohydrate contents in all treatments gradually decreased. Concerning the titratable acidity (T.A), treatment A is of the highest values, during the storage period, followed by treatments B and C, in order, Which came in agreement with .DorataKalika(2017) and FernandezCarcla (1998), who also added, that fiber addition significantly increased higher pH in control plain yoghurt sweetened with sucrose . T.A of all treatments in the present study, which ranged between 0.58 – 0.75 % , were increased gradually through the storage period and this was approved by (Mariana *et al.* , 2019) . pH values of all treatments behaved reverse trend to T.A , during storage period

Table 2. Chemical composition of yoghurt drink samples during storage.

Treatments	Storage periods (Days) (%)	Parameters						
		Total solids (%)	Acidity (%)	pH value (%)	Fat (%)	Total protein (%)	Ash (%)	Carbohydrates (%)
Control (C)	Fresh	14.5	0.58	4.22	0.10	2.30	0.40	11.63
	5	14.39	0.60	4.17	0.10	2.26	0.42	11.61
	10	14.22	0.63	4.12	0.20	2.21	0.44	11.47
	15	14.26	0.65	3.97	0.20	2.15	0.47	11.44
Treatment B	Fresh	15.25	0.63	4.26	0.20	2.68	0.47	7.95
	5	11.15	66ز0	4.20	0.20	2.63	0.48	7.84
	10	11.08	0.68	4.15	0.25	2.60	0.50	7.78
	15	11.03	0.70	4.00	0.15	2.58	0.52	7.68
Treatment A	Fresh	17.35	0.65	4.20	0.15	3.06	0.63	13.51
	5	17.26	070	4.26	0.20	2.97	0.66	13.48
	10	17.22	0.73	4.23	0.30	2.91	0.69	13.42
	15	17.20	0.75	3.93	0.15	2.87	0.71	13.33

As with the physical properties and the total dietary fibers contents, results indicated in Table (3) show the viscosity, serum separation and total dietary fibers of the experimented yoghurt drinks. Texture covers the whole appearance and sensation when drinking the beverage The apparent viscosity of all treatments showed that treatment A recorded the highest values along the storage period, being 232 – 88 CPs, at 50 rpm / min. speed and Spindle 5, compared to the other treatments . Fresh samples viscosity was 232 . 128 and 136 for treatments A , B and C, respectively, decreased gradually to 88 , 40 and 56 CPs , after 15 days of storage . The highest viscosity (%) was observed in treatments A and C, which might be due to the addition of sugar as well as oat fiber which improve the body and texture of food products through the thickening effect of the soluble fibers, which agree with Mc Cain etal. (2018) Meanwhile, Soukoulisetal. (2009) added that apparent viscosity increased in plain yoghurt with the addition of sweetener and fiber. It could also be observer by (Fernandez 1998) that the apparent viscosity increased with fiber addition , and attributed that to the interaction between the exogenous hydrocolloids and dairy proteins .

Regarding the serum separation (synersis), it could be established that the hydrocolloids can roughly be divided into two categories on the basis of their functionality in beverages : thickening and gelling agents . Data presented in Table (3) revealed that the lowest rate of whey separation was noticed in treatment A (containing sugar + oat), followed by treatment C and treatment B, in order. Treatment B characterized with the highest rate of synersis during storage, compared with the other 2 treatments. During storage, synersis increased and ranged between 2 – 11 , 10 – 18 and 6 – 15.5% for treatments A , B and C, respectively. Addition of sugar and oat addition played the essential role in that variation. Fortification of free fat yoghurt with oat flour decreased significantly the synersis value. Oat contained dietary fibers improved the body & texture throughout the storage period. Synersis gradually increased during the storage period. Similar results were obtained by Lucey , 2001, Hoefler , 2004, Soukoulisetal. (2009 and El- Samahyetal. (2014) and this was confirmed by El- Samahyetal. (2014).

Concerning the total dietary fibers , results indicated that treatments made by adding oat powder A and B contained the highest levels of dietary fibers being 0.31 and 0.33 %, in order, while the control contained 0.04%. Oat powder contained approximately 11.88%, dietary fibers and this was the responsible factor for that increase. Similar results were also revealed by Khalil & Blassy, (2017).

Table 3. Viscosity, synersis and dietary fibers of yoghurt drinks duringcold storage.

Treatments	Storage periods (days)	Viscosity (C.Ps)	synersis %	Total dietary fibers%
Control (C)	Fresh	136	-	0.04
	5	108	6	-
	10	80	11.5	-
	15	56	15.5	-
Treatment B	Fresh	128	-	0.33
	5	100	10	-
	10	75	15	-
	15	40	18	-
Treatment A	Fresh	232	-	0.31
	5	180	2	-
	10	110	7	-
	15	88	11	-

Free amino acids:

Essential amino acids:

Data in Table (4) revealed that treatment A of Y.D. had the highest concentration of 534.908 mg/g protein, and 406.024 mg/g protein in control treatment. The main reason of the decrease of these acids in the control sample C was the decrease of the concentrations of the following amino acids; methionine , valine , and therionine in the Y.D. In addition, it was free from oat flour (which contain approx. 11-16% protein).

Control Y.D (C) had The highest concentrations of lucine, isoleucine and the lowest of methionine were detected in it. On the other hand , Y.D. (A) had the highest concentration of valine and methionine, while Y.D. (B) had therionine, phenylalanine and Lysine .

The sulfur essential amino acid methionine was found in higher amounts in Y.D. treatments of A & B than in control one (C). These amino acid increase the nutritional value of any product and playing crucial role in the physiological and biological processes occurred in human body .

The amino acid valine was found with the highest concentrations among the EAA in of all the examined samples, whereas the amino acid tryptophan was not detected during analysis(Tamime& Robinson , 2007).

Data in Table (4) showed also that the amounts of EAA in Y.D. (A & B):control Y.D. (C) were 1.489 and 1.320 mg / g protein , respectively.

Non- Essential amino acids:

Amino acids aspartic, glutamic, tyrosine, histidine, serine and arginine were present in a highest concentrations in Y.D. (C), whereas proline and cysteine were in Y.D. (A) and alnine and glycine were in Y.D. (B),

Amino acid cysteine (containing sulfur) was found in very low concentration in Y.D. (C).

The highest concentrations of NEAA was detected in a very low concentration in Y.D. (C).

The highest concentrations of NEAA was detected in Y.D. (C) , being 537.033 mg / g protein, followed by 45.468 in Y.D. (A) and 405.388 in Y.D. (B), in order .

The amino acid glutamic was the predominant in all samples, whereas cysteine was found the lowest concentration.

The ratio betweenNEAA of Y.D. (A & B) to NEAA of Y.D. (C) were 0.841 and 0.755 mg / g protein .

Variations observed among the three Y.D. treatments were presumably due to the chemical composition and biological reactions occurred during storage period .

Table 4. Free amino acids of fresh yoghurt drink samples.

Amino acids	Amount mg / g protein		
	A	B	C
Essential amino acids (EAA)			
LysineLeusine	43.058	68.802	44.257
Isoleusine	32.691	44.553	52.840
Phenylealanine	15.355	17.923	20.981
Therionine	23.779	38.333	25.390
Methionine	65.345	73.190	62.600
Valine	107.342	97.355	33.918
Sum of (EAA)	217.157	194.801	166.038
Non-essential amino acids (NEAA)	604.727	534.908	406.024
Glutamic	165.208	140.069	220.109
Aspartic	83.913	62.274	85.293
Proline	9.699	8.686	8.685
Arginine	21.315	20.567	23.873
Serine	43.860	39.570	55.205
Glycine	31.402	34.896	30.664
Alanine	38.473	48.512	39.585
Histidine	19.034	19.953	21.362
Cysteine	0.748	0.687	0.077
Tyrosine	37.834	30.174	52.180
Sum of (NEAA)	451.486	405.388	537.033
EAA / Control	1.489	1.320	-
NEAA / Control	0.841	0.755	-
EAA / NEAA	1.339	1.319	0.756

***Tryptophane not determind**

The amino acid content of yoghurt is dependent on the titratable acidity of the product. Results obtained came in harmony with those observed by Luca (1974).

The ratio between EAA: NEAA was highest in Y.D. (A), being 1.339 while the corresponding values of Y.D. (B & C) were 1.319 and 0.756, respectively. Addition of oat flour to Y.D (A & B) was the main reason for that variation.

It could generally be concluded that:

1 - 17 amino acids of 20 (7 EAA and 10 NEAA) were detected in all fresh Y.D samples.

2 –Valine amino acid was the predominant one in EAA and Glutamic acid was the corresponding one in NEAA

3 -The presence of Lysine and sulfur amino acids (Methionine & cysteine) were vital in any product and increased its nutritional value .

4 – The ratio between EAA : NEAA was highest in Y.D (A) , followed by Y.D. (B) and Y.D (C) , in order .

5 - The highest amounts of EAA were noticed in A , B and C samples , respectively , while the corresponding ones of NEAA were C , B and A in a descending order.

Microbiological analysis:

Viable cell counts of lactic acid bacteria (LAB) in yoghurt drinks fortified with oat (treatments A and B were found higher than that in control treatment C (free from oat) , along the ripening period (Table 5) . The counts of fresh samples were 80 , 66 and 62 cfu × 10 ^{4} / g for A , B and C treatments , respectively , decreased through the storage period to 41 , 36 and 32 cfu × 10 ^{4} / g for the same treatments , owing to the continuously increase in acidity and the metabolic compounds resulted in the drinks .These results were in agreement with those mentioned by Fernandez - Garcla(1998.

Yeasts & Molds were appeared only in all treatments at the day 15 of storage with low counts , ranged between 1 – 3 cfu × 10 / g , and treatment B (contained stevia) recorded the lowest counts followed by treatments A and C , respectively. Similar results were also mentioned by Mahotoetal. (2020), who observed antimicrobial activities of stevia leaf extract.

Table 5. Counts of viableLactic acid bacteria and yeast and molds of drinks, during cold storage yoghurt

Treatments	Storage period (days)	Lactic acid bacteria (cfu× 10^4 /g)	Yeast & Molds (cfu × 10 /g)
	Fresh	62	-
	5	55	-
	10	50	-
Control (C)	15	32	3
	Fresh	66	-
	5	53	-
	10	42	-
Treatment B	15	36	1
	Fresh	80	-
	5	68	-
	10	53	-
Treatment A	15	41	2

Organoleptic evaluation:

(Paul Paquin (2009) as follows:

Evaluation of sensory properties of yoghurt drink treatments (A,B and C) revealed that the addition of oat improved the body & texture of the resultant drinks and minimized slightly the intensity of flavor, which agrees with those results noticed by Khalil &Blassy (2017). Meanwhile

Guggisbergetal. (2011)added that incorporating stevia in yoghurt is of too small effect on the body & texture.

Yoghurt drink A was found the best treatment followed by C and B treatments along the storage period. Flavor of treatment C was preferred than the other treatments. All the yoghurt drinks were acceptable as a general and no obvious defects were noticed, during storage.

CONCLUSION

Stevia freeze-dried + oat powder were successfully employed to producefunctional yoghurt drinks. All the formulated yoghurts maintained suitable counts of starter microorganisms through 15 days of cold storage. Finally, oat and stevia-fortified yoghurts showed great potential asalow calories functional dairy food, enhancing the antioxidant properties of yoghurt, during storage. The results of this study suggest that yoghurt may be a good matrix for the delivery of bioactive compoundspresent in oat and stevia. Considering that yoghurts are dairy products of great acceptance and are consumed daily worldwide .The use of oat + stevia powders can result in an easy industrial implementation because of yoghurt's well-known manufacturing process.

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إنتاج مشروب يوغورت وظيفي منخفض السعرات الحرارية مدعم بمسحوق حبوب الشوفان ومسحوق مستخلص نبات الإستيفيا

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تم تحضير مشروب اليوجهورت باستخدام يوجهورت مصنع من لبن فرز بقرى، بيرمييت، مسحوق بذور الشوفان، سكر سكروز ، مثبت للقوام صوديوم كربوكسى ميثايل سليولوز (CMC) ، مسحوق اوراق نبات الاستيفيا (كمحلى طبيعى بدون سعرات حرارية كبديل للسكروز) . وكانت المعاملات كما يلى :ا- تجارب اولية ...لاختيار افضل نسبة من سكر السكروز (4 - 8 %) & افضل نسبة من مسحوق الاستيفيا(0.1-0.5 %) وافضل نسبة من مثبت القوام (0.4 – 0.8 %) واظهرت النتائج ان نسبة 6% ونسبة 0.25 %..ونسبة 0.6% هى الافضل للسكر ، مسحوق الاستيفيا ، المثبت على التوالى ......وعلية تم اجراء المعاملات التالية:ب- معاملات البحث :* معاملة A : يوجهورت + بيرمييت (70 :30 %) + 6% سكروز + 0.6% CMC + 3% شوفان * معاملة B: يوجهورت + بيرمييت (70 :30 %) + 0.6% CMC + 3% شوفان + 0.25% مسحوق الاستيفيا .*معاملة المقارنة (C) : يوجهورت + بيرمييت (70 :30 %) + 6% سكروز + 0.6% CMC تم تخزين المشروبات الناتجة لمدة 15 يوم فى الثلاجة وتم تحليلها كل 5ايام كيماويا ، بكتريولوجيا ، ريولوجيا ، حسيا...كما تم تقدير الالياف الغذائية والاحماض الامينية الحرة فى العينات الطازجة عمر 1 يوم .واظهرت النتائج مايلى : كان اعلى مشروب من ناحية كمية الطاقة هو مشروب المعاملة A . كانت نسبة الجوامد الصلبة الكلية ، البروتين ، الدهن ، الكربوهيدرات والرماد الاعلى فى المعاملة A خلال مدة التخزين . كانت نسبة الكربوهيدرات والجوامد الصلبة الكلية منخفضة جدا فى المعاملة B لخلوها من السكروز . انخفضت نسبة البروتين والكربوهيدرات فى جميع المعاملات بتقدم مدة التخزين . كانت نسبة الحموضة الاعلى فى المعاملة A تليها المعاملة B ثم المعاملة C وذلك خلال مدة التخزين سلكت قيم ال pH اتجاها معاكسا لقيم الحموضة خلال مدة التخزين . سجل مشروب المعاملة A اعلى قيم اللزوجة والالياف الغذائية واقل قيم انفصال الشرش اثناء التخزين . وجدت 7 احماض امينيةاساسية & 10 احماض غير اساسية فى جميع المعاملات ...وكان حمض Valineهو السائد فى الاحماض الامينية الاساسية وحمض Glutamicالسائد فى الاحماض الامينية الغير اساسية . احتوت جميع المشروبات على الاحماض الامينية الكبريتية (methionine & cysteine) `ذات القيمة الغذائية العالية . كانت نسبة الاحماض الامينية الاساسية الى الغير اساسية عالية فى المعاملة A تليها المعاملة Bثم Cعلى التوالى . كانت اعداد البكتريا التابعة لجنس Lactobacilli عالية فى المشروبات المدعمة بالشوفان (معاملة A & B) إمقارنة بالكنترول . ظهرت الخميرة فى جميع المشروبات باعداد قليلة فى نهاية مدة التخزين . كان مشروب المعاملة A افضل المشروبات حسيا فى حين كان مشروب المقارنة (C) افضلهم من حيث الطعم والرائحة . كانت جميع المشروبات مقبولة بصفة عامة وخالية من اى عيوب واضحة خلال مدة التخزين . عموما...يمكن التوصية بانتاج مشروب يوجهورت وظيفى منخفض السعرات الحرارية ..مدعم بالشوفان ومحلى ببديل السكر (مسحوق اوراق نبات الاستيفيا) ليلبى مطالب الكثير من المستهلكين .