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THE EFFECT OF TALBINA AS A PREBIOTIC ON THE PRODUCTION OF PROBIOTIC LOW FAT YOGURT LIKE-PRODUCT

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ABSTRACT

The effect of supplementation with 10% Talbina and probiotic bacteria on low fat yogurt quality were studied. The viability of bacteria and some chemical, physical and organoleptic properties of low fat yogurt-like product during cold storage were studied. Addition of 10% Talbina improved the viability of starter culture and probiotic bacteria at 1st day and during cold storage also it's enhanced the products sensory evaluation. The viable counts of bacteria as a probiotic exceeded the recommended level above 10^6cfu/g. The values of pH & acidity of treatment T_2 & T_3 showed a higher in pH and lower acidity than control samples. Water holding capacity (WHC) and curd firmness (CF) for T_2& T_3 were decreased at 1st day. After that all treatments during storage showed increase in WHC and curd firmness. The flavour and aroma of yogurt are affected by the addition of 10% Talbina. At first day was observed decrease in comparing to the control samples. While during storage the level of carbonyl compounds was increase in all treatments

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Keywords: Talbina, low fat yogurt, probiotic, prebiotic

INTRODUCTION

Barley is an annual grass erect, 60-120 cm tall; leaves few, has a great similarity to wheat and oat **(Reed, 1976)**. Scientific name; *Hordeum*, Family; Graminaea. Barley and oat foods are healthful additions to the diet because of their ingredients containing low fat and high fiber, which have many

nutritional and health-enhancing uses **(**Food and Drug Administration (FDA), 2003).

Nowadays, barley is gaining renewed interest for food use due to its hypocholesterolemic property, desirable nutritional and functional characteristics. Abdel-Rahman, (2003).

Traditionally, barley has been used as general tonic for nerves and laxative, soothing agent, anti-diarrheal, hepato-tonic and antihypertensive. It was also described for the treatment of respiratory diseases such as tuberculosis B and general weakness for slow development of children; stomach and intestinal weakness as well as for inflammation of urinary bladder and kidneys and chronic constipation (El-Tagoury, 1999).

Barley is a functional foods, due to its rich in vitamins A, C, B1, B2, folic acid and B12; calcium; iron; potassium and chlorophyll (Jensen *et al*., 2006). Unlike most plants, barley grass provides all nine essential amino acids. It contains a wide spectrum of amino acids, enzymes, vitamins, minerals and phytochemicals. It promotes cell metabolism, providing cellular energy and for antioxidant effects, it has beneficial effect in asthma, obesity, skin rejuvenation and it's good for the health improvement to the digestive and respiratory systems.

Holtekjolen *et al*., (2008) reported that barley is gaining renewed interest as an ingredient for production of Functional Foods due to its high content of bioactive compounds such as β-glucans, tocopherols and tocotriends. Barley is an excellent source of soluble fiber such as β-glucans and contain a higher level of β-glucans.

Experimental studies reported that consuming barley reduce the total serum cholesterol values by 10%, decreased low density lipoprotein (LDL) cholesterol by about 8%, and increase high density lipoprotein (HDL) cholesterol by 16% (Braaten and Wood, 1994).

Talbina is a food product with high potential applications as a functional food. Talbina were used in ancient Arab for nutritional purpose. It was a product made from barley flour and milk, believing in Prophet Muhammad's (peace upon him) nutritional habits has no doubt great benefits to human health.

Scientific researchers have proven with evidence these benefits one day after another. Barley has been used in preparing Talbina which has a considerable therapeutic value and has been prescribed as a cure for many diseases (Sahih Muslim and Sahih Al-Bukhari).

Aisha, the Prophet Mohammed's wife, used to recommend Talbina for sick for those who grieved over a dead person based on a recommendation by the Prophet Mohammed peace by upon him (Hadith) (Manal *et al.*, 2013). Scientific indicated that whole grain cereal foods and oat meal or bran may reduce the risk of chronic heart disease CHD by lowering blood cholesterol levels (Truswell, 2002).

Scientists showed that melatonin reduce cholesterol levels blood which led to lowering blood pressure. Barley has the highest percentage of melatonin comparing with other cereals, thus it has a considerable role in reducing the risk of heart diseases **(**Abd El-Hassib, 2003).

Prophet Muhammad (P.U.H.) quoted as saying: "To-thheb be-baad el-hazan" (Sahih Al-Bukhari). Meaning relieves some of his sorrow and grief. Talbina is a cure for sadness. Clinical experiments confirmed the role of barley in psychological health enhancement.

Depression and grief are chemical disorders. Fortunately, barley is reach in most of the compounds that alter these disorders, enhancing psychological health. These effective compounds can be briefed as follows; potassium and magnesium which affect some nervous conductors, hence improve psychological status, vitamin B-complex affect some physiological interactions that control depression (Penninx *et al.*, 2000), vitamin E-like and vitamin A control depression especially in elderly persons, tryptophan which obviously affect the patient's psychological status and nervous conditions **(**Wolfe *et al.*, 1997 & Byerley *et al.*, 1987). In addition to melatonin that prevents sleeping disorders and help in enhancement of psychological status of patients.

Zimmermann *et al.*, (2013) indicated that an increased level of lipid peroxidation in the liver of rats subjected to high-fat diet, which was reduced by the consumption of barley extract (Talbina). Talbina has a laxative and anti-carcinogenic effect. Barley is reach in soluble and insoluble dietary fibers (**Carr &** Gallaher, 1996).

Aljaouni and Selim., (2017) suggested that Talbina extract exhibited strong antimicrobial potential and antimutagenie agent. The strongest antimicrobial activity of extract was recorded against *staphylococcus aurous* and the lowest activity was observed against *Candida albicans*. For the documented evidences raised here, it has been obviously justified that Prophet Muhammad (Peace Upon Him) did not speak of his own, but Allah taught him. As mentioned in the Holly Quran: In the name Allah "Nor does he speak of (his own) desire; it is only a Revelation revealed". (Surah 53-Al-Najm THE STAR, 3, 4).

The aim of this study, a reduction in fat content can be achieved by Talbina (barley extract) to provide the functionality of the missing fat and producing probiotic product.

MATERIALS AND METHODS

Milk supply:

Fresh raw cow's milk was obtained from the faculty herds, Agriculture, Minia University. All samples were from the morning milking.

Starters culture:

Yogurt starter culture consisted of (*Streptococcus salivarius subsp thermophilus*, *Lactobacillus delbureckii subsp. Bulgaricus* and *Bifidobacterium coagulans*) were obtained from

Cairo Microbiological Resource center (MIRCEN), Faculty of Agriculture Ain Shams University. The organisms were inoculated at (1:1:1).

Preparation of Talbina

Talbina as a barley bran flour was added directly to the milk yoghurt as ratio (10%), then incubated at 42 °C until coagulation, then cooled to 5°C±1. the yoghurt was made as described by Tamime and Robinson (1985). The yoghurt was preparation with or without bifidus starter culture (*Bifidobacterium Coagulans*).

Barley bran flour (6-rowed barley, Hordeum vulare L.) Giza 31 was obtained from Agriculture Research Center.

Manufacture of yoghurt

The full or low fat milk (1.5% fat) was heated in boiling water bath for 30 min, at 85°C and cooled to 42°C under running tap water, than inoculated with (1.5%) yoghurt starter culture (*Streptococcus salivarius subsp thermophilus* and *Lactobacillus delbrueckii* ssp. *bulgaricus*). Inoculated milk samples were incubated at 42 °C until complete coagulation at pH reached 4.6. Fermentation was stopped by cooling the fermented milk to 5°C±1 in refrigerator.

The manufacture of plain yoghurt without additives (Control 1), low fat yoghurt 1.5% fats (Control 2), low fat yogurt with probiotic bacteria (Treatment 1), low fat yogurt with 10% Talbina (Treatment 2) (yogurt like-product) and low fat yoghurt with probiotic bacteria and 10% Talbina (Treatment 3). All yogurt samples were stored at 5ºC±1 for 14 days.

Chemical analysis

Titratable acidity & pH

Yogurt samples were analyzed for titratable acidity according to Ling (1963). pH was measured using an E 512 type pH meter (Switzer land).

Acetaldehyde Content Determination

Acetaldehyde contents of samples were determined by Lees and Jago method **(**Lees & Jago, 1969).

Determination of Diacetyl and Acetoin:

Acetoin and diacetyl in yogurt samples were determined according to Westerfeleld, (1945).

Determination of curd firmness

Firmness of the formed gel (curd) was determined by the penetration method as described by Ibrahim, (1983).

Water holding capacity of yoghurt

Water holding capacity (WHC) was measured as described by Keogh and O'Kennedy (1998)

Microbiological analyses

Total microbial count:

The total bacteria count (TBC) was estimated using Nutrient agar as described by Chalmers, (1962).

Count of Lactic Acid Bacteria (LAB) group:

Counting the numbers of LAB group was used by the MRS agar (Biolife) as recommended by the Standard Methods for Examination of Dairy Products (1985). The MRS agar plates were incubated at 37°C for 48 h for lactobacillus counts.

Count of probiotic bacteria

Total viable *Bifidobacteria* counts were enumerated on modified Lactobacilli MRS (Oxoid Basing Stoke UK), according to methods described by Vinting and Mistry (1993).

Count of yeast and moulds

The enumeration of yeasts and moulds was made as recommended by the Standard Methods for Examination of Dairy Products (1985).

Organoleptic evaluation:

Sensory evaluation was performed by the staff members of the Dairy science department and was measured according to Bodyfelt *et al*., (1988) as follows flavour (40 points), body and texture (30 points) and appearance and colour (30 points).

RESULTS & DISCUSSION

pH and acidity

Results in Table (1) showed that the Talbina has effect on the pH value and acidity of treatment samples (T_2 & T_3). The values of T_2 & T_3 showed higher pH and lower acidity than C_1, C_2 and T1. These results may be due to the presence of fibers. These results are in agreement with Darwish (2008), Fernandez-Garcia *et al.,* (1998) and Fernandez-Garcia & McGregor, (1996). The pH values of all samples were decreased and acidity was increased during cold storage. These finding may be due to the activity of starter culture during cold storage.

Curd firmness

Texture is an important attribute of yogurt quality. Data in **Fig (1)** showed that Talbina incorporation resulted in lower firmness of yogurt samples comparing to control at first day. During storage all samples showed gradual increase in curd firmness. The increase in firmness during cold storage could be related to further pH reduction that likely caused gel structure to shrink with a consequent elevation of gel strength, the obtained results are in agreement with Sah *et al.,* (2016) Corredig *et al.,* (2011).

Water holding capacity (WHC)

Water holding capacity (WHC) of the control yogurt (C_1) was 53.1% after 1 day increased till 57.20% during 14 days storage at 5°C±1 Yogurt made from full-fat milk retained higher percentage of serum within its structure thus being characterized by decreased syneresis and increased WHC in comparison to the yogurt made from low fat milk. **Fig (2)** Addition of Talbina (beta-glucan) to the yogurt led to decrease values of WHC after 1day storage.

Table (1): Changes in pH and titratable acidity of yogurt samples during storage at 5ºC ±1.

Treatments	Storage period (Days)	TA*%	pH	Δ pH
Full fat yogurt Control (C1)	1	0.87	4.54	----
	3	0.88	4.51	0.03
	7	0.90	4.49	0.05
	14	0.92	4.44	0.10
Low fat yoghurt (LFY) Control (C2)	1	0.85	4.56	----
	3	0.87	4.52	0.04
	7	0.89	4.48	0.08
	14	0.91	4.42	0.06
LFY+ Probiotic (T1)	1	0.90	4.57	----
	3	0.94	4.53	0.04
	7	0.94	4.47	0.10
	14	0.97	4.40	0.17
LFY+Talbina (T2)	1	0.84	4.60	----
	3	0.87	4.54	0.06
	7	0.89	4.50	0.10
	14	0.92	4.45	0.15
LFY+Talbina +Probiotic (T3)	1	0.86	4.57	----
	3	0.89	4.51	0.06
	7	0.92	4.45	0.12
	14	0.95	4.39	0.18

*TA= Titratable acidity

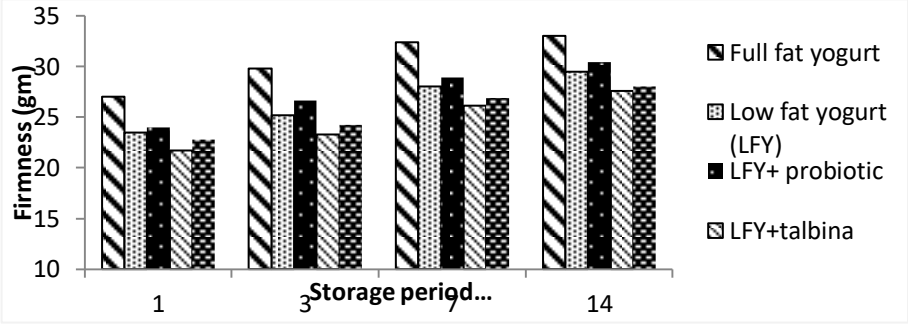

Fig (1): Changes in curd firmness of yogurt samples during storage at 5ºC±1.

While during storage the values of WHC were increased for T_1 & T_2. Data showed that WHC at 1st day was 49.20% and 49.80% for T_2 and T_3. But during storage its increased till (52% and 53.21% respectively.

This ability of beta-glucan was attributed to entrap water within the three dimensional

network of the product and elastic casein-protein-glucan matrix (Ozcan & Kurtuldu, 2014).

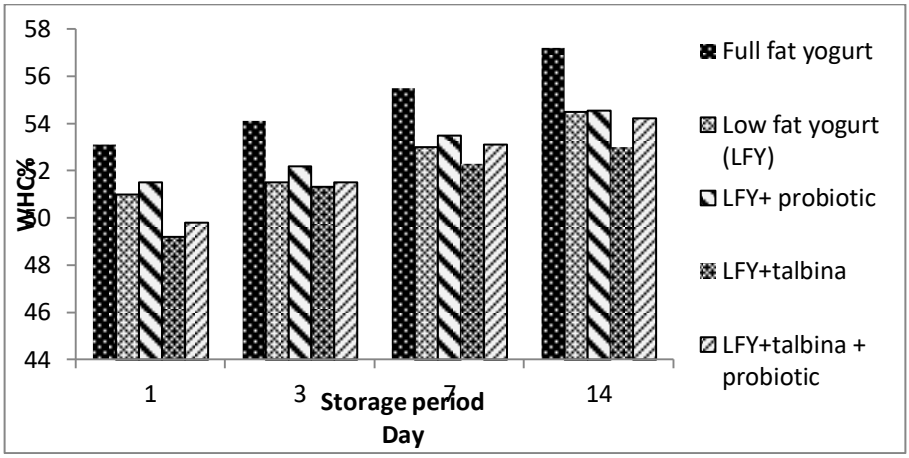

Fig (2): Changes in WHC% of yogurt samples during storage at 5°C±1.

Carbonyl compounds

The addition of Talbina (beta-glucan) had ameliorated the water holding capacity of non fat yogurt (NF). The physical stability of NF yogurt became similar to the full fat yogurt (FF). These results are in agreement with previous studies by Zeinab *et al*., (2013); Guzel-Seydium *et al*., (2005).

Data in Fig (3 a, b &c) showed that the higher acetaldehyde content was scored in control sample. But the lowest acetaldehyde content was found in treatment (T_2). This may be attributed to the replacement of yogurt by 10% Talbina, which may cause a reduction of aroma substances and acetaldehyde producing cultures in T_2 & T_3 yogurt- like product. These results are in agreement with Darwish, (2008). However, during storage acetaldehyde content was increased in all samples. The yogurts enriched with Talbina had a lower level of diacetyl and acetoin (0.275 & 0.342) than the control respectively, expressed as O.D at 540 nm in yogurt samples. During storage the level of diacetyl and acetoin was increased in control and all treatment samples. These results agree with opinion shared (Kilic and Kankaya, 2016). `The flavour and aroma of yogurt are affected by all milk components products of their thermal degradation and compounds formed as a results of enzymatic changes caused by homofermentative yogurt bacteria and heterofermentative bifidobacteria.

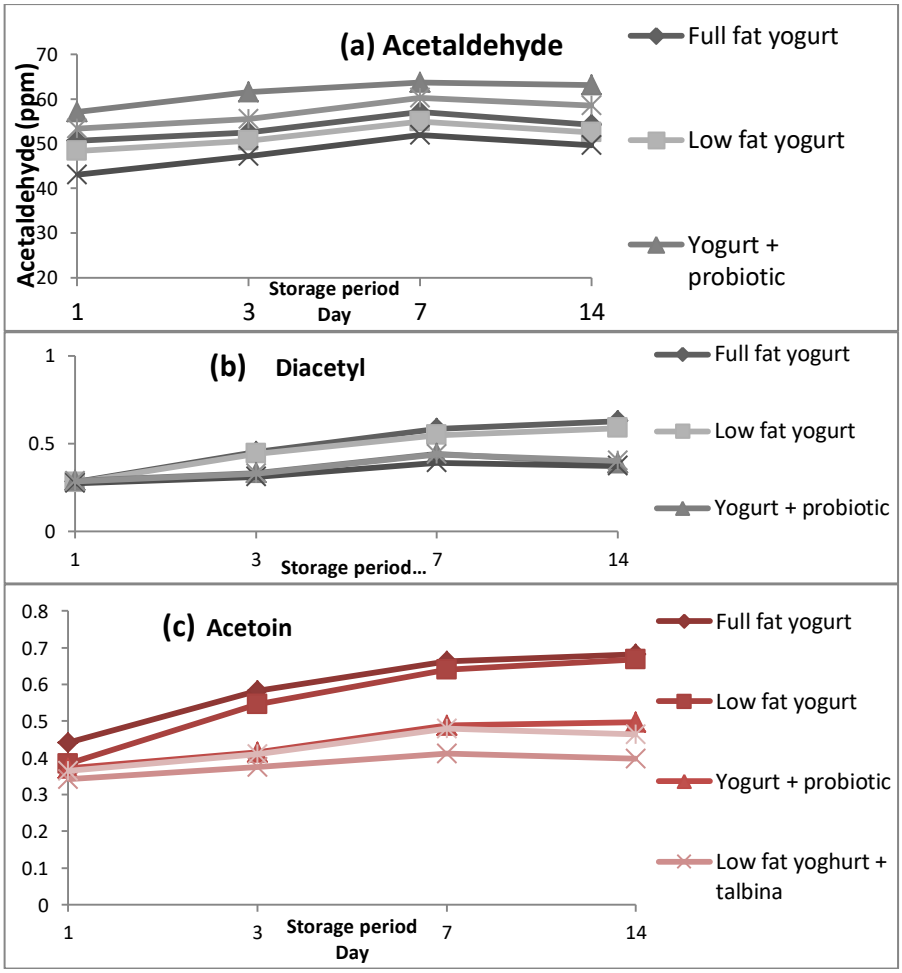

Fig (3 a, b &c): Concentration of flavour compounds in yogurts samples.

Viability of bacteria

Talbina also affect on viability of bacteria in yogurt-like product**.** Results in **Table (2)** showed that Talbina and storage time had effect on bacterial growth. On the first day and during storage the amount of starter culture and probiotic bacteria with Talbina was higher than control group.

Data in **Table (2**) showed that Talbina was increase the viability of starter culture and probiotic bacteria in low-fat yogurt. This may be due to presence of starch, nitrogenous compounds and the presence of structural polysaccharides such as beta-glucan in barley (Makras *et al*., 2005 and Desai *et al*., 2004).

The results in **Table (2)** showed also that the number of probiotic bacteria in T_2 & T_3 at 1st day and during storage time was higher than the minimum recommended probiotic number for exhibiting treatment effect (10^7Cfu/g). These results agreed with Hasani *et al*., (2017) and Saarela et al., (2006) showed that

barley bran has a higher effect on viability of *L. acidophilus* or *L.casei* than inulin and apple fiber.

Table (2) showed that the molds and yeasts were not detected in all samples when fresh and till the fourteen day storage. This may be due to the hygienic conditions where the manufacturing procedures took place. Similar results have been reported by Salem *et al.,* (2007), Taha *et al.,* (2007).

Sensory evaluation

Sensory evaluation is an important indicator of potential consumer preferences. The popularity of yogurt as a food component depends mainly on its sensory characteristics and addition of different flavors to yogurt has been found to increase opinion for consumers and help in marketing yogurt (Routrary and Mishra., 2011). The scores for organoleptic properties for yogurt samples during cold storage are presented in Table (3).

Table (2): Viability of bacteria of yogurt samples during storage at 5°C for 14 days.

Treatments	(Days) storage period	T.C NA cfu/g	Lactobacilli (MRS) cfu/g	Probiotic (MRSL) cfu/g	Lactococcus M17 cfu/g
Full fat yogurt control (1)	Zero	9.0×10^6	5.0×10^6	___	4.0×10^6
	1	9.4×10^6	5.2×10^6	___	4.4×10^6
	3	1.38×10^7	8.0×10^6	___	6.0×10^6
	7	1.4×10^7	8.3×10^6	___	6.5×10^6
	14	1.3×10^7	8.1×10^6	___	6.3×10^6
Low fat yoghurt control (2)	Zero	9.1×10^6	5.4×10^6	___	4.6×10^6
	1	1.0×10^7	5.7×10^6	___	5.0×10^6
	3	1.4×10^7	8.1×10^6	___	6.4×10^6
	7	1.5×10^7	8.7×10^6	___	6.8×10^6
	14	1.3×10^7	8.5×10^6		6.4×10^6
Yogurt+ Probiotic T1	Zero	5.4×10^7	2.0×10^7	4.0×10^7	1.1×10^7
	1	5.6×10^7	2.2×10^7	4.2×10^7	1.2×10^7
	3	7.4×10^7	4.0×10^7	6.0×10^7	2.0×10^7
	7	7.2×10^7	6.0×10^7	4.9×10^7	2.6×10^7
	14	6.8×10^7	5.0×10^7	4.1×10^7	2.510^7
Yogurt + Talbina T2	Zero	1.0×10^7	6.0×10^6	___	4.8×10^6
	1	1.2×10^7	6.4×10^6	___	5.2×10^6
	3	1.4×10^7	8.8×10^6	___	6.8×10^6
	7	1.5×10^7	9.2×10	___	7.1×10^6
	14	1.4×10^7	9.0×10^6	___	7.0×10^6
LF Y+ Probiotic + Talbina T3	Zero	1.5×10^7	5.8×10^6	6.2×10^6	4.0×10^6
	1	1.6×10^8	6.0×10^7	6.5×10^7	4.2×10^7
	3	1.8×10^8	6.4×10^7	7.0×10^7	5.0×10^7
	7	1.77×10^8	6.2×10^7	6.7×10^7	4.9×10^7
	14	1.7×10^8	6.1×10^7	6.4×10^7	4.8×10^7

* **Molds & yeasts** not detected

In generally, data showed that 10% Talbina had a good impact on the sensory properties points allocated for color, body, texture and mouth feel values. Incorporation of 10% Talbina (beta-glucan) into low fat yogurt milk improved the perceived creaminess of the product. It means the mouth feel of the product was also improved in comparison with low fat yogurt. Overall acceptability of the products was good.

Table (3): Effect of addition of Talbina on the organoleptic properties.

	Flavour & Aroma	Appearance & colour	Body & Texture	Total
Score	40	30	30	100
Full fat yogurt (C_1)	32	26	26	84
Low fat yogurt LFY (C_2)	28	22	20	70
LFY + probiotic bacteria (T_1)	30	22	21	73
LFY + Talbina (T_2)	26	22	20	68
LFY+ probiotic + Talbina (T_3)	27	22	21	70

Total scores of sensory evaluation for all samples were 84%, 70%, 73%, 68% and 70% for C_1, C_2, T_1, T_2 and T_3 respectively. Because the weak gel for T_2 and T_3 which is non-preferable for many consumers. It was not surprising that the scores evaluation test of T2 and T3 (yogurt with Talbina) gained the lowest scores. The obtained resultes are in agreement with Darwish, (2008) and Fernández-García and McGregor (1997).

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تأثير التلبينة كبريبيوتك على إنتاج منتج حيوى (شبيه الزبادى) المنخفض فى نسبة الدهن

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أجريت هذه الدراسة لمعرفة تأثير إضافة 10% تلبينة و بكتريا البروبيوتك على جوده الزبادى المنخفض فى نسبه الدهن. وتم دراسة كل من المحتوى البكتيرى وبعض الخواص الكيميائية والطبيعية والخواص الحسية للمنتج خلال فترة التخزين لمدة 14 يوم على درجة حرارة 5°م±1. وأدت إضافة 10% تلبية الى تحسين نشاط بكتريا البادئ وبكتريا البروبيوتيك والخواص الحسية للمنتج فى اليوم الاول من الصناعة وأثناء التخزين. ووجد ان المحتوى البكيرى للبروبيوتك تجاوز الحد الادنى المسموح به حتى يصبح منتج حيوى (10^6cfu/g). أظهرت المعاملة 2و3 ارتفاع فى pH وأنخفاض فى الحموضة مقارنة بالكنترول. وأظهرت الدراسة أن WHC و قوة الخثرة للمعاملة 2و 3 كانت منخفضة فى اليوم ألاول و حدث زيادة فى WHC وقوة الخثرة خلال فترة التخزين. أن أضافة 10% تلبينة أدت الى أنخفاض في مركبات الطعم والنكهة في اليوم ألاول ثم زادت خلال فترة التخزين.