STUDY OF THE EFFECT OF WHEAT GERM EXRACT ON THE PRODUCTION OF EXOPOLYSACCHARIDES FROM THE BIO-ENHANCERS

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ABSTRACT

The objective of this study was to investigate effect of wheat germ extraction on the fermented milk products, which prepared using single and two types of mixed cultures of *Lactobacillus acidophilus*, *Lactobacillus plantarum*, ready premixed and 1: 1 mixture with inoculation of 5% in reconstituted skimmed milk 12% TS Which reinforced with different concentrations of wheat germ extracts 0, 5, 10 and 15% for treatments (T1, T2, T3 and T4) respectively. The results showed that the height of the viscosity of all the products increased by the percentage of added wheat germ extract. The best treatment (10%) of T3, which was 52, 65, 57 and 64 mpa for each of the types of bacterial starter culture in the above respectively, compared to the reduction in the ratio of T4 (15%) was 51 and 63, 55 and 60 mpa. Furthermore The treatment of 10% (T3) showed the best production of exopolysaccharides (4.518, 4.869, 4.524, 4.668 mg / ml) and reduction with T4 (15%) to 3.870, 4.784, 4.275 and 4.049 mg . ml^{-1} for each of the above probiotics cultures used in processing of fermented dairy products، The results showed that *Lb. Plantarum* is the most efficient in the production of exopolysaccharides, compared to other starter cultures bacteria and its role in increasing the viscosity and improve the strength of the probiotics fermented milk product treatment is a good qualities according to the Iraqi standard (milk fermented therapeutic).

Keyword : prebiotics, probiotics, viscoelasticity, (EPS).
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دراسة تأثير مستخلص جنين الحنطة على انتاج السكريات المتعددة الخارجية من المعززات الحيوية

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المستخلص

تهدف هذه الدراسة بيان تأثيرمستخلص جنين الحنطة على انتاج السكريات المتعددة الخارجية من المعززات الحيوية حضر عدد من المنتجات اللبنية المتخمرة العلاجية باستعمال بوادئ منفردة ومختلطة لكل من بكتريا *Lactobacillus acidophilus* و *Lactobacillus plantarum* والبادئ المختلط الجاهز والبادئ المختلط بنسبة 1:1 من كلا النوعين في التصنيع بنسبة تلقيح 5% في الحليب الفرز المسترجع 12% مواد صلبة كلية والمدعم بتراكيز مختلفة من جنين الحنطة 0 و5 و10 و15 % بالمعاملات (T1, T2,T3,T4) على التوالي، أظهرت النتائج أرتفاع لزوجة كل المنتجات بزيادة نسب مستخلص جنين الحنطة المضافة وكانت أفضل معاملة T3 (10 %) التي بلغت 52 و65 و57 و64 mpa لكل من أنواع بواديء بكتريا المعززات الحيوية في أعلاه على التوالي مقارنة بأنخفاض النسبة عند المعاملة T4 (15%) بلغت 51 و63 و55 و60 mpa، كما وأظهرت المعاملة T3 (10%) أفضل انتاج للسكريات المتعددة الخارجية إذ كانت 4.518و4.869و4.524و4.668 mg. ml^{-1} وأنخفاضها بالمعاملة T4 (15%) الى 3.870 و4.784 و4.275 و4.049 mg . ml^{-1} لكل من أنواع بواديء بكتريا المعززات الحيوية في أعلاه على التوالي المستعملة في المنتجات اللبنية المتخمرة، وبينت النتائج تميز بكتريا *Lb. plantarum* الأكثر كفاءة في انتاج السكريات المتعددة الخارجية مقارنة ببكتريا البوادئ الاخرى ودورها في زيادة لزوجة وتحسين قوام المنتوج اللبني المتخمر العلاجي وهي من الصفات الجيدة على وفق المواصفة القياسية العراقية (اللبن المتخمر العلاجي).

كلمات مفتاحية: المحفزات الحيوية، المعززات الحيوية، نسبة اللزوجة، نسبة السكريات المتعددة الخارجية

***البحث مستل من رسالة ماجستير للباحث الثاني**

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INTRODUCTION

In recent years, there has been a wide tendency to introduce Lactobacillus species ,especially Lactobacillus ,as vital boosters isolated from the human digestive tract because of its various therapeutic adjectives of microorganisms .This has encouraged their use in properties such as the antagonistic be maintaining the natural balance of intestinal flora and lowering the level of cholesterol in the blood, as well as being used as a treatment for people suffering from lactose intolerance (16). Its contribution to reducing cancer incidence ,treatment of constipation, development of immune system in the body. (27). Its use in the manufacture of many food products for its role in improving flavor ,texture and prolong long food.(1,8). Lactobacillus has the ability to consumption and representation of mono and multilateral sugars so as to possess about twenty system of systems vectors of sugars (3) and the ability to secrete foreign multiple sugars Exopolysaccharides from the wall cellular (26) on two forms depending on their location either capsules linked to the cell surface capsular polysaccharides or put directly in the center of growth (10), and have different food application to be used as material stabilizing and viscosity increase improve the texture. Other Researchers (5,15) use alternative for fat in food as least fat to reduse calories and enhance the sense of taste Buchholz and they Seibel (6) and Sartor (21) , mentioned to Welman (29)economic importance and its health effects The *Lactobacillus acidophilus* of the best strain of bacteria Lactobacillus probiotic to posses resistance to the acidity of gastric juice and bile salts and acids and susceptibility adhesion to the intestinal mucous layer and settle longer with in the gut .Charalampopoulos and Rastall (7), they found the ability to produce hydrogen peroxide and its antagonistic towards pathogenic bacteria forming spores to produce many antibiotics such as Lactocidin, and its ability to produce lactic acid, which has done inhibitory to microorganisms and other sensitive low pH, also contains wheat germ essential nutrients (protein, fat, carbohydrates, minerals and vitamins),which is one of the food cereal important from health and human life and reduce the risk of his illness, (14). Is a sucrose and raffinose the largest proportion of carbohydrates (20). The aim of the research is to produce and improve nutritional value, to prolong the life of the fermention milk of a biologically enhanced structure, and to maintain the required number of bacteria to give it therapeutic status, with the best election of starter probiotic.

MATERIAL AND METHODS

Lactobacillus acidophilus was equipped from a Tablet (10 Billion) and *Lactobacillus plantarum* in the form a capsule which were processed by (Quest) for the production of probiotic bacteria starter and activated a number of times during implantation in skim milk and incubation until curd The components of the wheat germ used in the consolidation of carbohydrate, protein, fat, moisture, fiber and ash were estimated according to the standard methods listed in A.O.A.C(8) The fermented products were prepared using skim milk with the addition of (0,5,10 and 15)% extracted wheat germ ,according to the parameters shows in Table 1 and sterilized with the autoclave at 121c for 15 minutes and then cold and added % 5 mono starter from *Lactobacillus acidophilus* and *Lactobacillus plantarum* and starter mixed ready and starter mixed ratio 1:1 of both types and incubated at anaerobic condition at 37c for16 hours and then chemical and physical tests were done during the period of storage at 4 ℃.

Table 1. wheat germ extract percentages in samples

Treatment	percentages extract wheat germ
T1	Sample standard without addition
T2	5%
T3	10%
T4	15%

Determination of Viscosity

The Isang and Zhang methood (13) was followed by using (Brookfield Digital) device model DV-E USA Origin, as in Fig 1 to determination viscosity of flow resistance to flow, 22c and 50 rpm, which were calculated in mpa /s following manufacturers manual**.**

Fig 1. Brookfield Digital device for measuring the viscosity of fermented dairy

Determination of Exopolysaccharides (EPS): The estimated of exopolysaccharides by using phenol-sulfuric acid method, according to Alp & A slim (2)

Determination of Water-Holding Capacity (WHC): The method of Water-Holding Capacity Followed method (12) to estimate the viability of the fermented dairy for preservatives the water as character to obtain cohesive texture and smooth tissue in the final therapeutic products.

Statistical analysis: The Statistical analysis: SAS-System (22) was used in study the effect wheat germ percentages addition of the fermented dairy in the probiotic bacteria to produc (EPS) and high viscosity. The differences were compared between the means using the least significant difference test

RESULTS AND DISCUSSION

Table 2 shows chemical composition of wheat germ which accumnlate (50.7, 28.0, 8.1, 7.8, 2.9, 2.5) %for carbohydrates, proteins, fats, moisture, ash and fiber) respectively

Table 2. Chemical composition of wheat germ

Content	%
Carbohydrates	50.7
Proteins	28.0
Fats	8.1
Moisture	7.8
Ash	2.9
Fiber	2.5

Table 3 and Fig 2 shows the high viscosity in fermented dairy with the probiotic bacteria increasing the concentration by added of wheat germ to the bacterial species.The best treatment was T3 (52 ,65 ,57 ,64) mpa-s for *Lactobacillus acidophilus* and *Lactobacillus plantarum* and starter mixed ready and starter mixed ratio 1:1 of both types respectively. The viscosity is one of the most important qualities yoghurt which reflects the texture (formed by the sulfide bond between k-Casein and whey proteins and Casein deposition in the milk by the reduction of pH during the manufacturing process)with Rheological properties the most important of the quality milk fermented probiotic product. Ramchandarn (19) found reduction of lactose in the treatment of T4 (55, 63, 51, 60) Mpa-s as a result of its conversion to lactic acid by bacteria led to low viscosity. (24)

Table 3. viscosity products from the probiotic bacteria

Starter bacteria	Viscosity mpa-s			
	percentages extract wheat germ			
	%(0)T1	%(5)T2	(10)T3	(15)T4
Lb. acidophilus	4 5	48	52	51
Lb . plantarum	55	59	65	63
mixed ready	41	48	57	55
mixed ratio 1:1	51	54	64	60
LSD	7.201*			

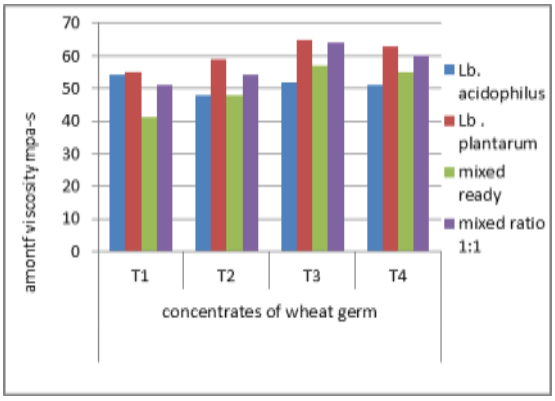

Fig 2. effect wheat germ on growing Starter bacteria

Fig 3. Crystals of EPS are white

The Statistical analysis revealed a significant differences between the means of the treatments for bacterial for species *Lb . plantarum* bacteria gave high Viscosity of the medium at T3 of 65 pa-s and can be inferred

as the most produce for EPS in the fermentation medium (Fig3) while, Looijesteijn (17) indicated that increased viscosity of the immunization food medium *Lactococcus lactis* indicated the high amount of sugar produced.The results of the statistical analysis in Table 4 a significant differences between the means of this treatment and the control, indicats the positive effect of the concentrations of wheat germ supplemented by (5 and 10)% to the amount of sugar produced, because it contains sugars and proteins which made from amino acids .The concentration of wheat germ extract 10%, the best value (4.518, 4.869, 4.524 ,4.668) mg. ml^{-1} for each of probiotic bacteria, respectively, (23).To estimate the quality of sugars, HPLC technology was used the wheat germ including raffinos it is composed of fructose ,glucose, galactose, which was found in one or more bodies linked to α- β- fructosidic lactosidase.The probiotic bacteria couhd be represent these sugars as an energy source because they possess the α- alactosidase which is a substance prebiotics (that is not digestible in the digestive tract in stimulating) the growth and effectiveness of probiotics bacteria and enhance growth within the intestine, and may be the effect of positive carbohydrates by stimulating its effective glycosyltransferase enzymes that act on the link of sugar nucleotide and polymerization during the process of multiple sugars. (18). While, the concentration of wheat germ 15% reduced the amount of sugar produced to 3.870, 4,784, 4.275and 4.049 mg. ml^{-1} respectively and may be due to the highest concentration of glucose in the food medium more than the required limit requires an increase in the number of vectors and nucleotides required for the binding of sugar in cytoplasm during the process of bacterial synthesis of sugar, and therefore requires more energy exchange, which in turn leads to the stability of the synthesis without increasing the amount of sugar, the product (9) Bacteria *Lb. Plantarum* are more efficient in the production of polysaccharides multiple high-weight and high melting point compared to the rest of the types of lactic acid bacteria, including Lb. acidophilus used in the study, giving high viscosity of the fermented. (28). The results of their researchers with (10), a positive relationship between the external polysaccharides and the viscosity of the product. EPS reduces the added stabilizers of the milk ferments by substituting them with important therapeutic bacteria by type of strain without having a bad effect on the flavor, The interaction of free water with polysaccharides for the formation of jelly and the addition of viscosity is a critical step in the fermented dairy industry and its active role in the overall visual appearance of the product.

Table 4. Product of total EPS from probiotic bacteria

Starter bacteria	EPS mg\ml			
	percentages extract wheat germ			
	(0)T1	(5)T2	(10)T3	(15)T4
Lb. acidophilus	0.003	2.380	4.518	3.870
Lb . plantarum	0.007	4.778	4.869	4.784
mixed ready	0.001	3.240	4.524	4.275
mixed ratio 1:1	0.001	4.528	4.668	4.049
LSD	1.074*			

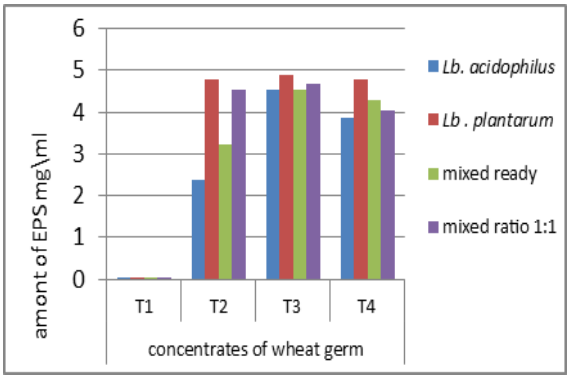

Fig 4. Effect wheat germ on growth of bacteria and the production of EPS

Table 5 shows a significant differences of susceptibility fermented dairy supported by extract wheat germ on keeping (WHC) as it was 53.0, and 43.0 and 31.5 and 39.5% on respectively for control treatment manufactured using the bacteria *Lactobacillus acidophilus* and *Lactobacillus plantarum* and starter of the mixed ready starter mixed by 1 : 1 for both types, and the ratio increased to (36.5 and 48.5, and 35.0 and 43.0) for the treatment of T2 and to (42.5 and 52.5, and 38.5, 50.0) for the treatment of T3 and to (49.0 and 56.0, and 45.0 and 53.5) for the treatment of T4 respectively, with increased susceptibility water retention (No separation of

Whey), an increase of wheat germ ratios to match these results (23) increase the amount of wheat germ added increased the ability to hold water to contain the fiber, carbohydarates and protein that have the ability to bind water as a result of the composition bonds of hydrogen between water molecules and the polar group of peptide chains, and the best strength of the product fermented dairy initially bacteria *Lb.plantarum* is believed that there is a correlation between the proteins of wheat germ and (EPS), It is produced by bacteria to get the best texture and smooth texture

Table 5.Water holding capacity (WHC)

Starter bacteria	WHC%			
	percentages extract wheat germ			
	(0)T1	(5)T2	(10)T3	(15)T4
Lb. acidophilus	53.0	36.5	42.5	49.0
Lb. plantarum	43.0	48.5	52.5	56.0
mixed ready	31.5	35.0	38.5	45.0
mixed ratio 1:1	39.0	43.0	50.0	53.5
LSD	6.983*			

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