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Potential impact of Rayeb and Kefir Milk on Alloxan-Induced Diabetic Rats

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Abstract

Rayeb and kefir milk is traditional fermented dairy products in various countries. Fermented milk manufacture depends on natural fermentation of raw milk by the activity of microorganisms and their enzymes. The beneficial bacteria and yeast is rich in amino acids, fatty acids, vitamins, minerals, enzymes and minerals. Effect of different concentrations 1.5 and 3 ml of rayeb, kefir milk and their mixtures on biological and biochemical changes of diabetic rats were investigated. Forty eight white male albino rats weighing 140±10g were used and divided to 8 groups, each group (6) rats. Rats infected of diabetic by injected with alloxan (150mg/ kg body weight). Glucose, serum liver functions (GOT GPT and ALP), T.G, T.C, LDL-c, HDL-c, VIDL-c and kidney functions (urea and creatinine) was determined. The obtained results of diabetic rats revealed that administration of rayeb; kefir milk and their mixtures improve serum glucose level, liver functions, kidney functions and lipid profile in rats. The best results recorded especially for 3ml mixtures fermented milk, besides the fact that it has so many health benefits.

Key words: Fermented milk, Hyperglycemia, Rats and Biochemical analysis.

Introduction

Dairy products made from locally produced raw milk are still a very important part of the daily diet; the nature of these products is different from one region to another depending on the local indigenous microflora, which in turn reflects the climatic conditions of the area. These products have one feature in common: fermentation by lactic acid bacteria (LAB) is an integral part of their manufacture **(Harun-ur-Rashid *et al.*, 2007)**.

Rayeb milk is a traditional fermented milk product popular in rural areas of Egypt; Rayeb milk is traditionally made from raw buffalo milk by spontaneously fermentation. The raw milk is left to sour spontaneously at room temperature until it coagulate; it contains a mixed culture of lactic acid bacteria and other fermentative organisms **(Abd El Gawad *et al.*, 2010)**.

Ismail *et al.*, (2018) reported that Rayeb milk is traditional fermented dairy products in various Arab countries. In rural areas, the method of Rayeb milk manufacture depends on natural fermentation of raw milk by the activity of microorganisms and their enzymes. Now, safe and standardized Rayeb milk is prepared on large scale in dairy products plants which use ABT culture (*Str. thermophilus, Lactobacillus acidophilus + Bifidobacterium*) in manufacture.

Kefir is one of the important fermented milk products which was originated in central Asia between the Caucasus Mountains and Mongolia, and is very popular in many countries nowadays, such as Turkey, Russia, Poland, Czech Republic, Slovakia, Hungary, Bulgaria, and Scandinavian countries, The United States, Brazil and Japan **(Grønnevik, 2011)**.

Kefir is a slightly sour, alcoholic and sparkling milk product produced in many countries with different names like “Kephir, Kiaphur, Kefyr, Kepher and Kype”. It is reported that according to the many literatures, the word of kefir derived from the Turkish word “keyf” which means “good feeling” **(Stepaniak and Fetlinski, 2002)**.

Kefir is a good source of many compounds that show antioxidant activity with their vitamins, phenolic acids, flavonoids, and sterols. Kefir milk also contains high percentage of fiber, vitamins A, D, E and B_1, minerals such as calcium, potassium, sodium, magnesium and iron. This composition of kefir provides more functionality to food such as improving beneficial effects for digestive system and preventing against colon cancer and helping to maintain an optimal weight due to high fiber content. Also kefir milk exhibits cholesterol and lipid-lowering effects **(Murphy *et al.*, 2004)**.

Huang *et al.*, (2013) reported that kefir consumption has been associated with several health-promoting properties, such as antimicrobial, anti-inflammatory, reduction of cholesterol and triglycerides plasma levels and has also been shown to exert beneficial effect on gut health. Kefir for centuries has been empirically used in many eastern European regions to treat different gastrointestinal diseases. Kefir has gained interest in the scientific community due to its health benefits against numerous diseases and infections.

Furthermore, **Zhang *et al.*, (2014)** reported a correlation between milk fermented with *L. gasseri* suppression of hyperglycemia in rats with type 2diabetes and prevention of chloride ion loss through up regulation of chloride ion-dependent genes and reduction of 7a-dehydroxylating bacteria. This suggests an important role for gut microbiota alleviation of type 2 diabetes.

Widodo, (2020) reported that oral administration of milk fermented with *L. casei* strain AP was the most effective against various diabetic parameters and similar in effect to that of the commercially available anti-diabetic drug metformin. These findings are expected to advance the development of fermented dairy products as functional foods, especially in the prevention of hyperglycemia, diabetes and related metabolic diseases in humans.

This study was conducted to investigate the effect of rayeb and kefir milk and their mixture on diabetic rats.

Materials And Methods

Materials

Kefir and rayeb milk:

Live organic milk kefir grain was obtained in 2015 from Amazon Company, USA. While rayeb milk obtained from local market at Met Ghamr City, Mansoura Governorate, Egypt.

The induction of experimental diabetes:

Diabetes was induces in normal healthy male albino rats by intra-peritoneal of alloxan 150 mg/kg body weight, according to the method described by **Desai and Bhide (1985)**.

The chemicals and kits

Casein, cellulose, choline chloride powder, and DL methionine powder, were obtained from El-Gomhoria Company for chemical, Drugs and Medical Instruments, Cairo, Egypt. Oil and corn starch were obtained from local market in Menoufia, Egypt. The kits were supplied by Bio Diagnostics Company Cairo, Egypt.

Experimental animals

A total of 48 adult normal male albino rats Sprague Dawley strain weighing 140±10 g were obtained from Vaccine and Immunity Organization, Ministry of Health, Helwan Farm, Cairo, Egypt.

Methods

Production of kefir milk

Kefir produced according to the method described by **Otles and Cagindi, (2003)** as follow:

Suspension of kefir grains (50 g of kefir grains added to a broth of 1000 mL of defatted milk containing 3% of sugar) were incubated into glass flasks at 25°C during 15 days. After that, samples of this cultivated kefir were subdivided and incubated for 24 hours at room temperature. Flasks were not sealed to allow fermentation gas release. After 24 h fermentation, the suspension was carefully filtered in sterile quantitative (fast filtration) filter paper. This procedure was repeated each 24 hours, until the end of the experiment.

Experimental design and animal group

Forty eight male albino rats, weighing 140±10g were used in the study. The animals were obtained from Vaccine and Immunity Organization, Ministry of Health, Egypt. Rats were housed in individual stales steel cages under controlled environmental conditions, in the animal house and fed 7 days on basal diet (casein diet) prepared according to **AIN, (1993),** period to start feeding on experimental diet for acclimatization. Rats are divided into 8 groups, each group which consists of six rats as follows: Group 1 (-ve): fed on basal diet only, as negative control. Group 2 (+ve): fed on basal diet and injected by a single dose of freshly prepared solution of alloxan (150mg/kg) and was used as a positive control group. Group 3: Diabetic rats fed on basal diet and administrating on the kefir milk by 1.5ml/day of the weight of the diet. Group 4: Diabetic rats fed on basal diet and administrating on the kefir milk by 3 ml/day. Group 5: Diabetic rats fed on basal diet and administrating on the rayeb milk by 1.5ml/day. Group 6: Diabetic rats fed on basal diet and administrating on the rayeb milk by 3ml/day. Group 7: Diabetic rats fed on basal diet and administrating on the mixture milk by 1.5ml/day. Group 8: Diabetic rats fed on basal diet and administrating on the mixture milk by 3 ml/day. The experiment period was take 28 days, at the end of the experimental period each rat weight separately then, rats are slaughtered and collect blood samples. Blood samples were centrifuged at 4000 rpm for ten minute to separate blood serum, and then kept in deep freezer till using.

Biochemical analysis

Lipids profile

Determination of total cholesterol

Serum total cholesterol was determined according to the colorimetric method described by **Thomas (1992)**.

Determination of serum triglycerides

Serum triglyceride was determined by enzymatic method using kits according to the **Young, (1975) and Fossati & Principe, (1982)**.

Determination of high density lipoprotein (HDL-c):

HDL-c was determined according to the method described by **Friedewaid (1972) and Grodon & Amer (1977)**.

Calculation of very low density lipoprotein cholesterol (VLDL-c)

VLDL-c was calculated in mg/dl according to **Lee and Nieman (1996)** was using the following formula:

VLDL-c (mg/dl) = Triglycerides / 5

Calculation of low density lipoprotein cholesterol (LDL-c)

LDL-c was calculated in mg/dl according to **Lee and Nieman (1996)** as follows:

LDL-c (mg/dl) = Total cholesterol – HDL-c – VLDL-c

Calculation of atherogenic index (AI):

Calculation of atherogenic index = (VLDL-c+ LDL-c) / HDL-c

This index was calculated as the (VLDL-c+ LDL-c/HDL-c ratio according to the formula of **Kikuchi-Hayakawa *et al.*, (1998)**.

Liver functions

Determination of serum alanine amino transferase (ALT), serum asparatate amino transferase (AST), serum alkaline phosphatase (ALP) were carried out according to the method of **Hafkenscheid (1979); Clinica Chimica Acta (1980) and Moss (1982**), respectively.

Kidney functions

Determination of serum urea and creatinine

Serum urea and serum creatinine were determined by enzymatic method according to **Henry (1974)** and **Patton & Crouch (1977)**.

Determination of glucose level

Serum glucose was measured using the modified kinetic method according to **Kaplan, (1984)** by using kit supplied by spin react. Spain.

Statistical analysis

The data were analyzed using a completely randomized factorial design **(SAS, 1988)** when a significant main effect was detected; the means were separated with the Student-Newman-Keuls Test. Differences between treatments of ($P \leq 0.05$) were considered significant using Costat Program. Biological results were analyzed by One Way ANOVA.

Results And Discussion

Effect of kefir and rayeb milk on glucose level of diabetic rats:

Data presented in Table (1) show the effect of kefir and rayeb milk on glucose level of diabetic rats. It is clear to notice that (+v) control group had higher glucose level than control (-v) with a significant difference. The mean values were 215.50 and 92.00 mg/dl, respectively.

Meanwhile, the lowest glucose level recorded for diabetic group recorded with 10 % mixture with a significant difference compared with other diabetic groups 5% rayeb milk. The mean values were 106.00 and 161.00 mg/dl, respectively. These results are in agreement with **Shafi *et al.*, (2019),** they reported that the blood glucose level was gradually reduced by increasing the *L. acidophilus* fermented milk concentration (0%, 2%, 4% and 6%) in the diet of diabetic rabbits over the treatment period. The maximum reduction in glucose level (62.91%) was observed in the blood of rabbits fed on the diet containing 6% prebiotic-supplemented *L. acidophilus* fermented milk after 4 weeks (28 days) of treatment duration.

The anti-diabetic potential of the product might be due to the improved efficiency of insulin, which ultimately increases glucose utilization by the cells. The results might be supported by the findings of **Perpetuo and Salgado (2003)** who reported that *L. acidophilus* (probiotics) has the ability to increase the efficiency of insulin by enhancing its stability in the body, which ultimately results in lowering the blood glucose levels.

Effect of kefir and rayeb milk on liver functions (ALP, GPT and GOT) of diabetic rats:

Data presented in Table (2) show the effect of kefir and rayeb milk on liver function (ALP, GPT and GOT) of diabetic rats. It is clear to notice that (+v) control group had higher ALP enzyme value than control (-v) with a significant difference. The mean values were 25.50 and 10.18U/L, respectively.

Meanwhile, the lowest ALP values recorded for diabetic group recorded with 10 % mixture with a significant difference compared with other diabetic groups (5% rayeb milk). The mean values were 18.66 and 11.40 U/L, respectively.

On the other hand, (+v) control group had higher GOT enzyme than negative control (-v) with significant differences. The mean values were 93.22 and 45.84 U/L, respectively. The results also indicated that the highest GOT level recorded for 5% kefir milk while, the lowest value recorded for 10% mixture milk with a significant difference. The mean values were 80.36 and 50.38 U/L, respectively.

In case of GPT enzyme, the obtained data indicated that (+v) control group had higher than negative (-v) control with no significant differences. The mean values were 88.54 and 38.98 U/L, respectively.

The results also showed that the highest GPT level recorded for 5% kefir milk while, the lowest value recorded for 10% mixture milk with a significant difference. The mean values were 70.16 and 40.76 U/L, respectively. These results are in agreement with **Rosa *et al.*, (2014)**. They concluded that kefir has an optimum concentration for reducing ALT levels and any dose higher than the optimum concentration would not encourage a healthier liver but rather increase cellular damage.

Also, **Alsayadi *et al.*, (2013)**, they reported that water kefir can prevent the disruption of the mitochondrial membrane, thereby maintaining the integrity of AST inside the mitochondria. The potency of water kefir is more effective in lowering AST levels than ALT levels.

Similar results obtained by **Morsy *et al.*, (2014)**. They found that fermented milk supplementation potentially alleviated the serum marker enzymes of liver function; ALT, AST, LDH, ALP and γGT. In addition, supplementation of milk kefir to chronic hepatitis C patients markedly decreased viral load when compared to the corresponding control patients.

Aspiras *et al.*, (2015) stated that fermented milk significantly reduce the levels of AST and ALT enzymes beyond the normal levels in rats groups. Furthermore, there is significant difference between the different dosages administered among the treatment groups. The dosage of fermented water kefir which provided the greatest hepatoprotective effect is 3 ml and 2ml for AST and ALT, respectively.

Effect of kefir and rayeb milk on total cholesterol and triglycerides of diabetic rats:

Data given in Table (3) showed the effect of kefir and rayeb milk on total cholesterol and triglycerides of diabetic rats. It is clear to notice that triglycerides (TG) of group (+V) control has higher value when compared to (-V) control group with significant differences. The mean values were 148.20 and 52.30 mg/dl, respectively.

While, the highest triglycerides value recorded for diabetic group with 5% rayeb milk, while, the lowest one recorded for diabetic group with 10% mixture milk with significant differences. The mean values were 95.10 and 60.80 mg/dl, respectively.

On the other hand, the value of cholesterol of (+V) control group has higher value when compared to (-V) control group with significant differences. The mean values were 135.00 and 90.50 mg/dl, respectively.

While, the highest triglycerides value recorded for diabetic group with 5% rayeb milk, and, the lowest value recorded for diabetic group with 10% mixture milk with significant differences. The mean values were 118.50 and 93.00 mg/dl, respectively. The results are in agreement with **Jones *et al.*, (2013)** they reported that probiotics can assimilate cholesterol and de-conjugated bile salts because they produce bile salt hydrolases, thereby reducing blood cholesterol concentrations. Bile salt hydrolase producing *L. acidophilus* CHO-220 has been shown to significantly reduce plasma total cholesterol and LDL-cholesterol levels in combination with prebiotic inulin.

Also, **Huang *et al.*, (2013)** found that the consumption of fermented dairy products including kefir has been proposed as a strategy to reduce levels of circulating cholesterol and to improve lipid profile **i**n humans and animals.

Effect of kefir and rayeb milk on serum lipid profiles of diabetic rats

Data given in Table (4) show the effect of kefir and rayeb milk on serum lipid profiles includes high density lipoprotein cholesterol (HDL-c), low density lipoprotein cholesterol (LDL-c) and very low density lipoprotein cholesterol (VLDL-c) of diabetic rats. It could be concluded that the high density lipoprotein cholesterol (HDL-c) of (-V) group has higher value when compared to (+V) control group with significant differences. The mean values were 52.05 and 27.67 mg/dl, respectively.

While, the highest HDL-c value recorded for diabetic group with 10% mixture milk, while, the lowest one recorded for diabetic group with 5% kefir milk with significant differences. The mean values were 51.50 and 37.61 mg/dl, respectively.

In case of low density lipoprotein cholesterol (LDL-c), it is clear that the low density lipoprotein cholesterol (LDL-c) of control group (+V) has higher value when compared to control (-V) group with significant differences. The mean values were 96.87 and 8.81 mg/dl, respectively.

The highest (LDL-c) value recorded for diabetic group with 5% rayeb milk, while, the lowest one recorded for diabetic group with 10% mixture milk with a significant differences. The mean values were 59.54 and 29.34 mg/dl, respectively.

On the other hand, the high density lipoprotein cholesterol (HDL-c) of (+V) group had higher value when compared to control (-V) group with significant differences. The mean values were 29.64 and 10.46 mg/dl, respectively.

The highest VLDL-c value recorded for diabetic group with 5% rayeb milk, while, the lowest one recorded for diabetic group with 10% mixture milk with significant differences. The mean values were 19.02 and 12.16 mg/dl, respectively. These results are in agreement with **Liu *et al.*, (2002)**. They demonstrated that an increase in HDL-cholesterol on using milk-fermented or sugar-fermented kefir preparations. In addition, supplementation of milk kefir markedly decreased the cardiovascular risk indices, indicating it's anti-hyperlipidemic and cardio protective efficacies.

Maeda *et al.*, (2004) reported that animals that consumed hyperlipidemic diets associated with kefiran showed a reduction in total cholesterol, low-density lipoprotein cholesterol *(*LDL-c), and triglycerides in serum, as well as cholesterol and triglycerides in liver compared with controls.

Kiessling *et al.*, (2002) found that HDL levels increased after 6 months of feeding yoghurt supplemented with *Lactobacillus acidophilus* and *Bifidobacterium longum*, thereby producing an improved low density lipoprotein (LDL)/HDL cholesterol ratio.

Effect of kefir and rayeb milk on serum urea and creatinine of diabetic rats

Data presented in Table (5) show the effect of kefir milk on serum and urine concentration of uric acid, urea and creatinine of diabetic rats. It is clear to notice that serum urea of (+V) group has higher value compared to (-V) control group with significant differences. The mean values were 35.56 and 72.64 mg/dl, respectively.

The highest urea value recorded for diabetic group with 5% rayeb milk while, the lowest one recorded for diabetic group with 10% mixture milk with a significant difference. The mean values were 67.48 and 38.30 mg/dl, respectively.

In case of serum creatinine, the value of (+V) group has higher value when compared to (-V) control group with significant differences. The mean values were 4.80 and 1.52 mg/dl, respectively.

The highest serum creatinine value recorded for diabetic group with 5% rayeb milk while, the lowest one recorded for diabetic group with 10% mixture milk with significant differences. The mean values were 0.99 and 0.89 mg/dl, respectively. The results are in agreement with **Amartey *et al.*, (2015),** it is well documented that because of diabetic complications, some mild kidney dysfunctions can occur kidney dysfunctions ultimately result in elevated levels of blood urea and creatinine. The reason for the elevation of urea content in blood might be due to its positive relationship with the blood glucose level.

Shafi *et al.*, (2019), elaborated that urea and creatinine levels in the blood of the rabbits were significantly reduced due to the hypoglycaemic effect of the intake of *L. acidophilus* fermented milk.

Urdaneta *et al.*, (2007), they reported that kefir reduces tissue lipid peroxidation levels, increases antioxidant enzyme activities and glutathione levels, and reduces the levels of serum urea, creatinine and TNF-α significantly. Kefir reduced the levels of serum urea, creatinine and TNF-α significantly.

Table (1) Effect of kefir, rayeb milk and their mixtures on glucose level of diabetic rats

Parameters / Groups	Glucose level mg/dl
	M±SD
G_1 C (-)	92.00^{g}±0.12
G_2 C (+)	215.50^{a}±0.15
G_3 (1.5 ml Kefir)	155.96^{c}±0.13
G_4 (3 ml Kefir	123.10^{e} ±0.11
G_5 (1.5 ml Rayeb milk)	161.00^{b} ±0.10
G_6 (3 ml Rayeb milk)	137.50^{d} ±0.12
G_7 (1.5 ml Mixture)	120.00^{e} ±0.13
G_8 (3 ml Mixture)	106.00^{f}±0.11
LSD ($p \leq 0.05$)	**4.150**

Each value is represented as mean ± standard deviation (*n* = 3).
Mean under the same column bearing different superscript letters are different significantly ($p \leq 0.05$).

Table (2): Effect of kefir, rayeb milk and their mixtures on liver functions of diabetic rats

	ALP U/L	GOT U/L	GPT U/L
	M±SD	M±SD	M±SD
G_1 C (-)	10.18^{g}±0.13	38.98^{g}±0.15	45.84^{h}±0.14
G_2 C (+)	25.50^{a}±0.11	88.54^{a}±0.12	93.22^{a}±0.10
G_3 (1.5 ml Kefir)	17.52^{c}±0.14	69.32^{b}±0.16	78.24^{c}±0.12
G_4 (3 ml Kefir	14.09^{e}±0.12	54.66^{c}±0.11	60.72^{e}±0.15
G_5 (1.5 ml Rayeb milk	18.66^{b}±0.10	70.16^{b}±0.13	80.36^{b}±0.14
G_6 (3 ml Rayeb milk)	15.88^{d}±0.16	49.26^{d}±0.14	65.14^{d}±0.10
G_7 (1.5 ml Mixture)	13.74^{e}±0.13	46.14^{e}±0.10	54.96^{f}±0.12
G_8 (3 ml Mixture)	11.40^{f}±0.12	40.76^{f}±0.15	50.38^{g}±0.13
LSD ($p \leq 0.05$)	**0.682**	**1.750**	**2.150**

Each value is represented as mean ± standard deviation (*n* = 3).
Mean under the same column bearing different superscript letters are different significantly ($p \leq 0.05$).

Table (3) Effect of kefir, rayeb milk and their mixtures on serum triglycerides, and serum total cholesterol of diabetic rats

Parameters / Groups	Triglycerides mg/dl	Total cholesterol mg/dl
	M±SD	**M±SD**
G_1 C (-)	148.20^{a}±0.15	90.50^{g}±0.15
G_2 C (+)	52.30^{g}±0.10	135.00^{a}±0.11
G_3 (1.5 ml Kefir)	88.60^{c}±0.11	111.20^{c}±0.13
G_4 (3 ml Kefir	74.00^{e}±0.12	97.80^{d}±0.14
G_5 (1.5 ml Rayeb milk)	95.10^{b}±0.13	118.50^{b}±0.11
G_6 (3 ml Rayeb milk)	79.30^{d}±0.13	100.10^{d}±0.10
G_7 (1.5 ml Mixture)	72.90^{e}±0.11	96.80^{e}±0.12
G_8 (3 ml Mixture)	60.80^{f}±0.10	93.00^{f}±0.10
LSD ($p \leq 0.05$)	**3.650**	**3.140**

Each value is represented as mean ± standard deviation (n = 3)
Mean under the same column bearing different superscript letters are different significantly ($p \leq 0.05$).

Table (4): Effect of kefir, rayeb milk and their mixtures on HDL-c, LDL-c and VLDL-c of diabetic rats

Groups	Parameters		
	HDL-c mg/dl	**LDL-c mg/dl**	**VLDL-c mg/dl**
	M±SD	**M±SD**	**M±SD**
G_1 C (-)	52.05^{a}±2.80	8.81^{h}± 0.93	29.64^{a}± 0.69
G_2 C (+)	27.67^{d}±1.71	96.87^{a}±1.58	10.46^{d}±1.20
G_3 (1.5 ml Kefir)	37.61^{cd}±0.50	56.23^{c}±2.41	17.27^{b}±0.90
G_4 (3 ml Kefir	40.46^{c}±1.38	42.54^{d}±0.83	14.80^{c}±1.60
G_5 (1.5 ml Rayeb milk)	39.94^{c}±0.90	59.54^{b}± 1.91	19.02^{b}± 1.72
G_6 (3 ml Rayeb milk)	45.51^{b} ±1.30	38.73^{e}±1.15	15.86^{bc}±1.20
G_7 (1.5 ml Mixture)	47.90^{b}±1.50	34.32^{f}±0.52	14.58^{c}±0.40
G_8 (3 ml Mixture)	51.50^{a}±1.90	29.34^{g}±0.60	12.16^{d}±0.20
LSD ($p \leq 0.05$)	**2.850**	**3.218**	**2.570**

Each value is represented as mean ± standard deviation (n = 3).
Mean under the same column bearing different superscript letters are different significantly ($p \leq 0.05$).
HDL-c= High density lipoprotein Cholesterol. LDL-c =Low density lipoprotein Cholesterol

Table (5): Effect of kefir, rayeb milk and their mixtures on serum urea, and serum creatinine of diabetic rats

Groups	Parameters	
	Urea mg/dl	**Creatinine mg/dl**
	M±SD	**M±SD**
G_1 C (-)	35.56^{g}±0.12	1.52^{d}±0.10
G_2 C (+)	72.64^{a}±0.10	4.80^{a}±0.60
G_3 (1.5 ml Kefir)	60.74^{c}±0.13	3.49^{b}±0.30
G_4 (3 ml Kefir	51.34^{e}±0.10	2.77^{c}±0.11
G_5 (1.5 ml Rayeb milk)	67.48^{b}±0.15	3.67^{b}±0.40
G_6 (3 ml Rayeb milk)	57.58^{d}±0.13	3.37^{b}±0.50
G_7 (1.5 ml Mixture)	44.42^{f}±0.10	2.45^{c}±0.20
G_8 (3 ml Mixture)	38.30^{g}±0.11	1.88^{d}±0.10
LSD ($p \leq 0.05$)	**2.820**	**0.731**

Each value is represented as mean ± standard deviation (n = 3).
Mean under the same column bearing different superscript letters are different significantly ($p \leq 0.05$).

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التأثيرات المحتملة للبن الرايب والكفير فى الفئران المصابة بالسكر والمستحث بالألوكسان

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الملخص العربى

اللبن الرايب والكفير من منتجات الألبان المخمرة التقليدية في مختلف البلدان. يعتمد تصنيع الألبان المتخمرة على التخمر الطبيعي للبن الخام عن طريق نشاط الكائنات الحية الدقيقة وإنزيماتها. البكتيريا والخميرة المفيدة غنية بالأحماض الأمينية والأحماض الدهنية والفيتامينات والمعادن والإنزيمات. تمت دراسة تأثير تركيزات المختلفة 1,5 , 3 مل/ يوم من اللبن الرايب والكفير ومخلوطهم على التغيرات البيولوجية والكيميائية الحيوية للفئران المصابة بمرض السكر. تم استخدام ثمانية وأربعين من ذكور الفئران البيضاء وزنها 140 ± 10 جرام وقسمت إلى 8 مجموعات ، كل مجموعة (6) فئران. تم اصابة الفئران المصابة بمرض السكر عن طريق حقنها بواسطة 150ملجم/ كجم من وزن الجسم. تم تقدير مستوى الجلوكوز، وظائف الكبد في الدم (ALP , GPT , GOT) ، T.G، T.C، LDL-c، HDL-c، VIDL-c ووظائف الكلى (اليوريا والكرياتينين). أظهرت النتائج التي تم الحصول عليها من الفئران المصابة بمرض السكر أن تناول اللبن الرايب و الكفير ومخلوطهم أدى إلى تحسين مستوى الجلوكوز في الدم ووظائف الكبد ووظائف الكلى والدهون في الفئران. وسجل المخلوط من الألبان المتخمرة بجرعة 3 مل / يوم أفضل النتائج ، بالإضافة إلى أن له العديد من الفوائد الصحية.

الكلمات الدالة: الألبان المتخمرة ــــ ارتفاع مستوى السكر ـــ الفئران ـــ التحاليل الكيميائية الحيوية.