

The Effect of Different milk types and its yoghurt by various types of Bacterial Culture on Rats induced to Diabetes.

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Abstract

Diabetes is a global health problem in the world. Probiotic therapies are going to be an effective alternative therapeutic strategy in the treatment and management of diabetes. The objective of this study was to evaluate the effect of different milk types, conventional yoghurt and probiotic yoghurt from bifidobacterium on serum blood glucose, lipid profile, liver and liver enzymes for rats induced to diabetes. In this study, two strains of conventional yogurt, *Lactobacillus Bulgaricus* and *Streptococcus salivarius* and in combination with either probiotics bacteria *Bifidobacteria infantis* and *Bifidobacteria longum* B6 for the production of fermented soymilk and cow milk for feeding 96 male albino rats induced with STZ. Results revealed that fermented soymilk by *Bifidobacteria* was able to significantly decrease glucose levels, total cholesterol concentrations and triacylglycerols compared to conventional yogurt types and milk types. In conclusion soy-protein consumption reduces serum blood glucose and lipid profile for rats induced to diabetes.

Key words: Soymilk, Cow milk, Whey protein, yogurt, serum blood glucose, lipid profile.

Introduction

Type 2 diabetes mellitus (T2DM) is the main form of diabetes and comprises more than 90% of people living with diabetes mellitus, worldwide. As the 21st century, has the

most diabetogenic environment in human history, it is estimated that the current prevalence of 415 million, will reach 642 million people in 2040 (IDF, 2016). Cardiovascular disease, as one of several chronic disorders, is the major complication of type 2 diabetes mellitus (T2DM). Cardio-vascular disease may result from associated abnormalities of plasma lipid and lipoprotein metabolism (Dunn, 2010). Alteration in plasma lipid and lipoprotein profile has been documented in diabetic patients (Shafir and Raz, 2003). There are products that may directly promote atherosclerosis through changes in endothelial, macrophage, and smooth muscle cells functions. Therefore, improving dyslipidemia would be effective to prevent complications of diabetic patients (Rader, 2007).

Plants and animal products are a rich source of various functional foods, which have health benefits. Probiotics are one of the functional foods that link diet and health. Probiotics "For Life" are living, health-promoting microbial food ingredients that have a beneficial effect on humans (Chuayana *et al.*, 2003).

The primary probiotic bacteria associated with dairy products have been *Lactobacillus acidophilus*, *Lactobacillus casei*, and *bifidobacteria*. Studies using animal models of diabetes have also shown that *Lactobacillus acidophilus* and *Lactobacillus casei* attenuate oxidative stress and have antidiabetic effects (Harisa *et al.*, 2009; Yadav *et al.*, 2007). Soymilk has been a rich source of protein which is inexpensive (Derbyshire *et al.*, 1976) and abundantly available. Soymilk is used in various food products such as tofu, fruit flavored puddings, calcium and protein rich

soymilk. In addition to protein, soybeans also contain various nutrients and functional components including isoflavonoids (Davis *et al.*, 2005). Regular consumption of soy protein may help to reduce symptoms associated with type 2 diabetes. Soy has been shown to decrease postprandial hyperglycemia, to improve glucose tolerance and to decrease amounts of glycosylated hemoglobin (Heneman *et al.*, 2007).

The fermentation of soymilk products changes the bioactive components, such as isoflavonoids and peptides, in ways which may alter their efficacy in the treatment of type 2 diabetes. Therefore, in this controlled trial, the current study aimed to investigate the effect of different milk types, conventional yoghurt and probiotic yoghurt from *bifidobacterium* on blood serum glucose and lipid profile for rats induced to diabetes.

Subject and Methods

1.1 preparation of Soymilk:

Soybeans were obtained from local markets around Cairo city during winter 2018. The soybean seeds were washed and soaking soybeans in distilled water 10 times their weight at overnight, and the mixture was mixed in a blender. Then, the mixture filtered to make soymilk. The soymilk were sterilized at 121°C for 15 min and cooled to 37°C then stored at 4°C (Hou *et al.*, 2000).

1.2 Cow Milk:

Cow milk were obtained from local markets during winter 2018, and used as a raw material to manufacture yoghurt and probiotic yoghurt.

1.3 Whey protein:

Ras cheese sweet whey was obtained from Dina Farms Company during winter 2018 for food as by-products.

1.4 Cultures:

The *bifidobacterial* cultures were using DeMan-Rogosa-Sharpe Broth Agar (MRS) medium.

1.4.1 Yoghurt culture:

Lyophilized culture for direct vat set "DVS" type *Lactobacillus dulbrueekii* sub sp. *Bulgaricus* and *streptococcus salivarius* subsp. Thermophiles were obtained from Dairy Microbiology Department, National Research center.

1.4.2 Probiotic yoghurt culture:

Highly concentrated and standardized freeze-dried culture for direct vat set "DVS" type *Bifidobacterium infantis* and *bifidobacterium longum* Bb-46 were obtained from Dairy Microbiology Department, National Research center.

2-2 Methods:

2.2.1 Preparation of traditional yoghurt from milk and soymilk:

Cow milk was inoculated with 3% of 1:1 mixture of *S. salivarius* ssp *thermophilus* and *L. dulbrueekii* ssp *bulgaricus* which were used as starter yoghurt culture according to (Tamime and robinson, 1988).

2.2.2 Preparation of probiotic yoghurt from milk and soymilk:

Cow milk was inoculated with 3% of 1:1 mixture of *bifidobacterium infantis* and *bifidobacterium longum* Bb-46 which were used as starter probiotic culture according to (El-sayed *et al.*, 1998).

Analytical methods part (1):

2.3 Chemical analysis:

Protein ($N \times 6.25$), fat, ash, calcium (Ca) determined according to the AOAC method (AOAC, 2007). Total carbohydrate was calculated by difference (Alvarez *et al.*, 2007). PH value was measured by using Orion pH-meter, model 501 at 20°C.

2.3.1 Animal feeding experiments:

96 male albino rats average weight (220 ± 20 g) were obtained from agriculture research center. They were housed in caged in temperature and humidity-controlled room. All rats fed for on basel diet for one week.

2.3.2 Induction of diabetic:

After acclimation, expect rats for group 1 (normal group), all remaining rats were injection with sterptozotocin (STZ) 0.55mg/kg in sodium chloride 0.09% for 5 days.

After injection animals were received 5% glucose solution overnight (**wohaieb and godin,1987**).

2.3.3 Basal Diet

Basal diet was composed of 37g casein (16% protein), 10g corn oil (10% fat), 5g cellulose (5% fiber), 4g mineral mixture (4%), 1g vitamin mixture (1%) and corn starch up to 100g according to (**Anderson et al.,1994**).

Design of the experiment:

96 male albino rats of Sprague-Dawley strain. Every 8 rats placed in a cage and then we feed the rats on the basal diet.

The rats were divided into two main groups as follows:

The first main group (control negative group): consisting of eight rats were fed on the basal diet.

The second main group were divided into 11 sub-groups contain 8 rats for each group injected first with streptozotocin (STZ) 0.55mg/kg in sodium chloride 0.09% for 5 days to cause diabetes and divided into :

The first subgroup: fed on basal diet as a positive control group.

The second subgroup: fed on basal diet + 5ml milk.

The third subgroup: fed on basal diet + 5 ml soymilk.

The fourth subgroup: fed on basal diet + 5 ml whey protein.

The fifth subgroup: fed on basel diet + 5 mlwhey protein and soymilk.

The sixth subgroup: fed on basel diet + 50gyoghurt from buffalo milk.

The seventh subgroup: fed on basel diet + 50g yoghurt from soymilk.

The eights subgroup: fed on basel diet + 50g yoghurt from soymilk and whey protein.

The nineth subgroup: fed on basel diet + 50g probiotics from buffalo milkBb-12& Bb-46.

The ten subgroup: fed on basel diet + 50g probiotics from soymilk Bb-12& Bb-46.

The eleven subgroup: fed on basel diet + 50g probiotics from soy milk and whey protein Bb-12& Bb-46.

Biological Determination:

The plasma glucose was determined at 546 nm according to the method described by **(Tietz and Ash, 1995)**. Plasma total lipids were determined at wavelength 525 nm according to the method of**(Knight *et al.*, 1972)**. Total cholesterolwas determined at546 nm according to the method of**(Richmond,1973)**.Plasma high density lipoprotein-cholesterol (HDL-C) at 546 nmwas performed as described by **(Fruchart, 1982)**. The serum uric acid was determined at 510 nm according to method reported by **(Barham and Trinder, 1972)**. Serum urea nitrogen was determined at 550 nm according to the method described by **(Fawcett and Soctt,1960)**. Serum creatinine was

determined at 510 nm as given (**Larsen, 1972**). Alanine amino transferase (ALT) and aspartate amino transferase (AST) activities were determined calorimetrically at 505 nm according to the method of (**Reitman and Frankel, 1957**) for all parameters under studying which had been estimated in serum samples were made by using spectrophotometer (model DU 4700) and were analyzed by using biodiagnostic and spectrum kits.

Statistical analysis:

The results were statistically analyzed using SSPS computer. Analysis of variance by one way ANOVA test using Duncan's multiple range tests.

Result and discussion:

Serum blood glucose:

Type 2 diabetes mellitus (T2DM) is the main form of diabetes and comprises more than 90% of people living with diabetes mellitus, worldwide (**IDF, 2015**). Diabetes and its complications are the leading causes of death globally and they are responsible for 5 to 20 percent of healthcare (**Atkins, 2009**).

The data present in Table (1) showed that the effect of different milk types, yoghurt from *lactobacillus* and yoghurt from *bifidobacterium* on the plasma glucose level for diabetic rats. There were significant ($p \leq 0.05$) increases in serum blood glucose in the positive control group compared with the negative and other groups because the injection with streptozotocin (STZ) can damage pancreatic β -cells. The mechanism of β -cells damage by STZ through

transporting STZ into β -cells via glucose transporter GLUT2 (Szkudelski, 2012). The highest reduction in blood glucose was tended for probiotic yoghurt soy milk and conventional soy yoghurt.

Soy milk group has higher ($p < 0.05$) levels in decreasing plasma glucose than cow milk and whey protein in diabetic rats. These results are similar to those reported by Mueller *et al.*, 2012 whom suggests that the context in which soy is consumed (unsweetened vs. sweetened) is likely important to reduce blood glucose in type 2 diabetics rats and reduce diabetes risk.

Moreover, it has also been posited that soy isoflavones inhibit insulin release from the pancreas and glucose uptake into the intestinal brush border by restraining protein tyrosine kinase activity (Akiyama *et al.*, 1996) or decreasing sodium-dependent glucose transporters (Vedavanam *et al.*, 1999). An alternative hypothesis is that soy isoflavones are a marker of a healthy soy-based diet. Regular consumption of soy protein may help to reduce symptoms associated with type 2 diabetes. Soy has been shown to decrease hyperglycemia, to improve glucose tolerance, and to decrease amounts of glycosylated hemoglobin (Heneman *et al.*, 2007).

The results reported that the groups feed on fermentation yoghurt from *bifidobacterium* and *Lactobacillus* of soy milk and cow milk groups showed significant ($p \leq 0.05$) decreased plasma glucose than the groups which fed on soy milk and cow milk without fermentation. The decreasing may be due to fermentation

improved nutritional and functional properties and increased content of small bioactive compounds (**Chien *et al.*, 2006**). Fermentation can also enhance nutritional and functional possessions of food by transformation of substrates into bioactive molecules (**Marco *et al.*, 2017**). In this context, fermentation of soybean/soy milk has reported to improve bioavailability of isoflavones, assists in digestion of protein, and provide more soluble calcium, reduced level of carbohydrates and increased level of bioactive isoflavones and bioactive peptides in ways which may alter their efficacy in the treatment of type 2 diabetes (**Young *et al.*, 2010 & Singh *et al.*, 2014**).

Table (1) The Effect of Different milk (cow, soya and Sweet whey protein) and its yoghurt by various types of bacterial culture on blood glucose for rats induced to diabetes.

Groups		Initial Glucose	After 2 weeks	After 4 weeks	After 6 weeks	Percentage of glucose reduction
Control negative group (-)		90.8 ^a ±4.6	89.8 ^a ±7.12	90.2 ^a ±3.7	88.6 ^a ±2.7	2 %
Control positive group (+)		321.4 ^a ±10.9	329.4 ^a ±12.7	319.2 ^a ±17.1	312.6 ^a ±19.6	2.7%
Milk types	cow milk	324.2 ^{ab} ±10.9	238.4 ^b ±18.8	212.4 ^b ±11.2	144.4 ^{bc} ±14.4	55%
	Soymilk	297.4 ^{ab} ± 23	192.2 ^{cd} ±14.5	145 ^{cd} ±14.2	101.4 ^d ±5.8	66%
	Whey protein	303.4 ^{ab} ±15.2	247 ^b ±12.2	214.4 ^b ±12.1	153.4 ^b ±10.7	49%
	Whey protein and soymilk	295.6 ^{ab} ± 28	193 ^{cd} ±20.1	155.4 ^d ±15	110.4 ^d ±10.3	62%
conventional yoghurt	Yoghurt from cow milk	300 ^{ab} ±19.9	229.4 ^b ±14.3	197.4 ^b ±17.2	135 ^d ±9.4	55%
	Yoghurt from soymilk	312 ^{ab} ±24.1	187 ^d ±14.2	132.6 ^d ±12.3	99.6 ^d ±7.5	68%
	Yoghurt from soymilk and whey protein	315.4 ^{ab} ± 30.7	190.8 ^d ±18.4	141.6 ^d ±17.3	101.6 ^d ±10.4	68%
Probiotic Yoghurt from <i>bifidobacterium</i>	probiotic yoghurt from cow milk	312 ^{ab} ±17.4	213.6 ^{bc} ±13.2	194.6 ^b ±19.9	124.4 ^d ±16.3	57%
	probiotic yoghurt from soymilk	318 ^{ab} ± 27.7	181.2 ^d ±26.8	126.8 ^d ±12.9	94.8 ^d ±6.4	70%
	probiotic yoghurt from soymilk and whey protein	316.4 ^{ab} ± 31.3	187.4 ^d ±22.4	140.8 ^d ±17.8	100.4 ^d ±6.3	68%

• Values denoted arithmetic means ± standard deviation of the mean. • Colum with different letter means that there were statically significant differents at (P<0.05).

The results showed that the group fed on the probiotic yoghurt from *bifidobacterium* soymilk and cow milk is significantly ($p \leq 0.05$) decreased the level of plasma glucose compare with *Lactobacillus* yoghurt of soymilk and cow milk group. This result is in agreement with **Ejtahedet al., 2012**, who reported that probiotic yogurt significantly decreased fasting blood glucose ($P < 0.05$).

Serum lipid profile:

Cardiovascular disease, as one of several chronic disorders, is the major complication of type 2 diabetes mellitus (T2DM). Cardio-vascular disease may result from associated abnormalities of plasma lipid and lipoprotein metabolism (**Dunn, 2010**). Alteration in plasma lipid and lipoprotein profile has been documented in diabetic (**Shafir & Raz, 2003**). People affected with hypercholesterolemia may avert the use of cholesterol-lowering drugs by practicing dietary control or supplementation of probiotics and/or prebiotics (**Roberfroid, 2005**).

The data illustrated in Table (2), showed the effects of different milk types, yoghurt from *lactobacillus* and probiotic yoghurt from *bifidobacterium* on serum total cholesterol and triglycerides in normal and diabetics rats. The results revealed that, the serum total cholesterol and triglycerides in control positive group were significant at ($p \leq 0.05$) decrease between among all studies groups. The best result showed in the group fed on probiotic soy yoghurt when compare with control negative group. The probiotic

soy yoghurt from *bifidobacterium* group has decreases value of TC and TG than other groups.

The soy milk group showed significant at ($p \leq 0.05$) differences among cow and whey protein because soymilk contain isoflavones that lead to decreasing the TC and TG. The result was agreed with the many previous studies (Sirtori *et al.*, 2002 , Teixeira *et al.*, 2000 & Wang *et al.* , 2004). Desroches *et al.*, 2004 whom suggest that the consumption of a soy protein diet may induce cardio protective and beneficial changes in the LDL size phenotype and that those effects are independent of the isoflavone component of soy.

Table (2): The Effect of Different milk (cow, soya and Sweet whey protein) and its yoghurt by various types of bacterial culture on lipid profile for rats induced to diabetes.

Groups		mg/dl Mean SD±			
		Total cholesterol	Percentage of total cholesterol reduction	Triglycerides	Percentage of triglycerides reduction
Control negative group (-)		83.8 ^c ± 4.1	-	78.1 ^d ± 2.1	-
Control positive group (+)		123.5 ^a ± 3.6	-	103.7 ^a ± 3.3	-
Milk types	cow milk	96.1 ^b ± 4.7	22.1%	89.5 ^{bc} ± 2.9	13.6%
	Soymilk	94.9 ^b ± 2.06	23.1%	83.2 ^c ± 1.7	19.7%
	Whey protein	119.5 ^a ± 3	3.2%	99.1 ^b ± 3.6	4.4%
	Whey protein and soymilk	98.8 ^b ± 3.1	20.0%	90.3 ^b ± 3.1	12.9%
conventional yogurt	Yoghurt from cow milk	92.6 ^{cb} ± 2.8	25.0%	84.2 ^c ± 1.4	18.8%
	Yoghurt from soymilk	88.3 ^d ± 3.7	28.5%	80.4 ^c ± 1.6	22.4%
	Yoghurt from soymilk and whey protein	91.8 ^c ± 2.4	25.6%	83.1 ^c ± 1.6	19.8%
Probiotic Yoghurt from <i>bifidobacterium</i>	probiotic yoghurt from cow milk	90.4 ^c ± 2.3	26.8%	81.3 ^c ± 2.6	12.6%
	probiotic yoghurt from soymilk	84.3 ^c ± 2.1	31.7%	77.4 ^d ± 2.7	25.3%
	probiotic	88.5 ^c ± 3.3	28.3%	80.9 ^c ± 2.07	21.9%

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	yoghurt from soymilk and whey protein				
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• Values denoted arithmetic means \pm standard deviation of the mean. • Colum with different letter means that there were statitically significant different at (P<0.05).

The groups fed on the fermentation yoghurt from *bifidobacterium* and *Lactobacillus* of soymilk and cow milk groups showed significant at ($p \leq 0.05$) differences than among the rats fed soy milk and cow milk without fermentation. The fermentation has beneficial health effects on their host, when enter the intestine with an adequate amount. Some of these health effects include: lowering hypercholesterolemia, lactose intolerance, diabetes mellitus (**Zhuang *et al.*, 2012**).

The result showed that the group fed on the probiotic yoghurt from *bifidobacterium* soymilk and cow milk is significantly ($p \leq 0.05$) decrease. The level of TC and TG compare with *Lactobacillus* yoghurt of soymilk and cow milk group. This result is in agreement with **Mohamadshahi *et al.*, 2014** who suggest that consuming probiotic yogurt can improve lipid abnormalities in patients with T2DM.

Some studies indicated that probiotics may be able to prevent increased levels of total cholesterol (TC), LDL-c and balance the ratio of LDL-c/HDL-c by deconjugating of bile, hydrolysis of bile salts and increase cholesterol absorption, which consequently prevent and reduce the prevalence of cardio-vascular disease and reduce diabetes complications (**Baroutkoubet *et al.*, 2010**). The results are in agreement with **Lee *et al.*, 2009** whom showed that short

chain fatty acids that are produced by lactic acid bacteria could inhibit the enzymatic synthesis of cholesterol. Probiotic bacteria may also facilitate excreting of cholesterol through feces (**Begley *et al.*, 2006**). Furthermore, these bacteria can assimilate cholesterol and lead to its reduction. Moreover, it is suggested that *bifidobacteria* bacteria may bind with cholesterol and inhibit its reabsorption in the body (**Ooi & Liong, 2010**).

Serum lipoprotein HDL, LDL and VLDL-c:

Data present in Table (3), showed the effect of different milk types, yoghurt from *lactobacillus* and probiotics yoghurt from *bifidobacterium* on blood serum lipid profile for diabetic rats. The results revealed that, the serum of HDL-C, LDL-C and VLDL-C showed significant ($p \leq 0.05$) differences among all studies groups at ($p \leq 0.05$) compare with control positive group. The group feed on soymilk showed significant ($p \leq 0.05$) differences among cow and Whey protein that means the soy milk was more effective than cow milk in increasing serum HDL value and decreasing serum VLDL-C and LDL-C value in diabetic rats. This is due to soymilk contained isoflavones, Postulated mechanisms include inhibition of cholesterol absorption or enhanced bile acid excretion, and increased receptor mediated clearance (**Khosla *et al.*, 1991**) LDL receptor activity hydroxylase activity (**Potter, 1990**).

The group feed on the probiotic yoghurt *bifidobacterium* is more effective than group feed on *Lactobacillus* yoghurt of soymilk and cow milk group. Therefore, return to the probiotic active in assimilate cholesterol and lead to its reduction. Previous studies on

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probiotic have reported beneficial effects on serum lipid profiles there is more effect than those made by conventional yogurt (Kaushik *et al.*, 2009 & Agerbaek *et al.*, 1995). The result showed that the probiotic soy yoghurt from *bifidobacterium* group had the highest value HDL than other groups. On the other hand the probiotic yoghurt soymilk group had lowest value of VLDL-C and (LDL-C) cholesterol in rats.

Table (3) The Effect of Different milk (cow, soya and Sweet whey protein) and its yoghurt by various types of bacterial culture on serum lipoprotein fraction for rats induced to diabetes.

Groups		Mg/dl Mean SD±							
		HDL-C	Percentage of HDL-C reduction	LDL-C	Percentage of LDL-C reduction	VLDL-C	Percentage of VLDL-C reduction	CVD Risk %	AL
Control negative group (-)		47.7 ^a ±1.2	-	20.5 ^c ±2.5	-	15.6 ^d ±0.4	-	1.7	0.75
Control positive group (+)		30.9 ^d ±1.18	-	71.9 ^a ±1.8	-	20.7 ^a ±0.6	-	3.9	2.9
Milk types	cow milk	38.3 ^c ±1.2	23.9 %	39.9 ^b ±3	44.5 %	17.9 ^b ±0.5	13.5 %	2.5	1.5
	Soymilk	43.7 ^b ±1.3	41.4 %	34.6 ^c ±0.46	51.8 %	16.6 ^c ±0.3	19.8 %	2.1	1.17
	Whey protein	30.2 ^d ±1.1	2.2 %	69.5 ^a ±1.2	3.3 %	19.8 ^b ±0.7	4.3 %	3.9	2.9
	Whey protein and soymilk	37.6 ^c ±.68	21.6 %	43.14 ^b ±1.8	29.9 %	18.06 ^b ±0.6	12.7 %	2.6	1.6
conventional yogurt	Yoghurt from cow milk	41.7 ^b ±.9	34.9 %	34.1 ^c ±1.6	52.5 %	16.8 ^b ±0.3	18.8 %	2.2	1.22
	Yoghurt from soymilk	46.6 ^a ±1.3	50.8 %	25.7 ^d ±2.1	64.2 %	16 ^c ±0.3	22.7 %	1.8	0.9
	Yoghurt from soymilk and whey protein	42.3 ^b ±.5	36.8 %	32.7 ^c ±1.6	54.5 %	16.8 ^c ±0.3	18.8 %	2.2	1.17
Probiotic Yoghurt from <i>bifidobacterium</i>	probiotic yoghurt from cow milk	44.1 ^b ±1.5	42.7 %	30.1 ^{cd} ±0.3	58.8 %	16.2 ^c ±0.5	21.7 %	2.0	1.03
	probiotic yoghurt from soymilk	49.5 ^c ±1.4	60.1 %	19.4 ^c ±0.4	73.0 %	15.4 ^d ±0.3	25.6 %	1.7	0.7

	probiotic yoghurt from soymilk and whey protein	45.7 ^a ±1.01	47.8 %	26.7 ^d ± 1.9	62.8 %	16.1 ^c ± 0.4	22.2 %	1.9	0.9
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• Values denoted arithmetic means ± standard deviation of the mean. • Colum with different letter means that there were statically significant different at (P<0.05).

The rats fed on the yoghurt from *bifidobacterium* and *Lactobacillus* of soymilk groups showed significant at (p≤0.05) differences among the rats fed soymilk without fermentation this is due to the fermentation improved the lipid profiles and enhances the viability of these microorganisms. This result was in general agreed with the many previous studies (Beavers *et al.*, 2010, Vij *et al.*, 2011 and Wang *et al.*, 2004). Champagne *et al.*, 2009 reported soymilk fermented with *Bifidobacterium* significantly decreased the levels of very low-density lipoprotein (VLDL) and low-density lipoprotein (LDL)-cholesterol in rats. These results are approximately in agreement with Wang *et al.*, (2004) who reported that fermented soy yoghurt with *bifidobacterium* significantly decreased the levels of total plasma cholesterol, VLDL and LDL-cholesterol in rats.

The probiotic soy yoghurt from *bifidobacterium* and *Lactobacillus* of groups has higher HDL-c value and lower VLDL and LDL cholesterol than the yoghurt from *bifidobacterium* and *Lactobacillus* of cow milk. Soy isoflavones in soy yoghurt improves serum lipid profiles, vascular reactivity, and protection of LDL against oxidation.

Conclusion:

This trial showed that consuming soy-protein consumption reduces serum blood glucose and lipid profile. Probiotic yogurt from soy milk

improved the lipid profile status and on rats induced to diabetes. These findings suggest that probiotic yogurt is a functional food that can exert antidiabetic.

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