



STUDY EFFECT OF FEEDING ON LOW LIPIDS KASHKAWAN CHEESE USING LIPIDS MIMETIC SUCH AS K -CARRAGEEN IN SOME HEALTH AND PHYSIOLOGICAL INDICATORS OF WHITE MICE

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ABSTRACT

This study aimed to develop non-traditional dairy products with health benefits by investigating the effects of feeding on Kashkawan cheese made from skim milk. The research involved the addition of lipid mimetics, specifically K-Carrageen at a concentration of 0.2%, to assess their impact on various feeding and health indicators. The inclusion of lipid mimetics resulted in a reduction in the daily weight gain of the experimental animals, as well as lower levels of total cholesterol, triglycerides, and harmful lipids (LDL and VLDL). Conversely, there was an increase in beneficial HDL lipids. Additionally, lipid mimetics contributed to a decrease in blood sugar levels and improved the efficacy of liver enzymes (GOT, GPT, and ALP) compared to the positive control group, which was fed full-fat milk. Furthermore, the lipid mimetics enhanced immune system efficiency by increasing cytokine levels of interferon-kama and maintaining total white blood cell counts within normal ranges and there were significant different between treatments. The treatment with added k- carrageen at a concentration of 0.2% excelled the other treatments.

Key words: Kashkawn cheese, Low Lipids Mozzarella Cheese, Lipids Mimetic, K- Carrageen, Health and Physiological Indicators, White Mice.

دراسة تأثير التغذية على جبن القشقوان منخفض الدهن باستخدام بدائل الدهن المتمثلة بالكاباكراجيين في بعض المؤشرات الصحية والفسلجية للفئران البيض

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الخلاصة

هدفت هذه الدراسة إلى تطوير منتجات ألبان غير تقليدية ذات فوائد صحية من خلال التحقيق في آثار التغذية على جبن القشقوان المصنوع من الحليب خالي الدسم. وتضمن البحث إضافة بدائل الدهون، وتحديدًا الكاباكراجيين بتركيز 0.2٪، لتقييم تأثيرها على مختلف مؤشرات التغذية والصحة. أدى إدراج محاكيات الدهون إلى انخفاض في زيادة الوزن اليومية للحيوانات التجريبية، فضلاً عن انخفاض مستويات الكوليسترول الكلي والدهون الثلاثية والدهون الضارة (LDL و VLDL). وعلى العكس من ذلك، كان هناك زيادة في دهون HDL المفيدة. بالإضافة إلى ذلك، ساهمت محاكيات الدهون في انخفاض مستويات السكر في الدم وتحسين فعالية إنزيمات الكبد (GOT و GPT و ALP) مقارنة بمجموعة التحكم الإيجابية، التي تم تغذيتها على الحليب كامل الدسم. علاوة على ذلك، عززت محاكيات الدهون كفاءة

*This article is taken from the first researcher's master's thesis.



الجهاز المناعي من خلال زيادة مستويات الساييتوكان cytokine من إنترفيرون كما والحفاظ على إجمالي عدد خلايا الدم البيضاء ضمن النطاقات الطبيعية وكانت هناك فروقات معنوية بين المعاملات .

الكلمات المفتاحية: جبن القشقوان، منخفض الدهون ، بدائل الدهن ، الكابا كارجيين ، المؤشرات الصحية والفلسجية ، الفران البيض.

INTRODUCTION

The markets is required meet the consumer's wishes in the discussion of providing functional food, providing the consumer with healthy food and prolonging life and improving the quality of the product (Vaikousi & Biliaderis 2005; Lafta, 2024). Because the consumer has become more aware and aware of the necessity of the connection between diet and healthy food, so the demand for the manufacture of healthy food products has increased, as a result, the attention of food industries has begun to manufacture functional foods that use natural alternatives in addition to manufactured products (Fagan *et al.*, 2006). The positive effect of the food hygiene system and the health effect of promoting the food industry on the development of new food products with healthy functions, the fakes face the challenge of determining the type of these alternatives as well as the nutritional values that enable them to be highly efficient alternatives for the production of products with good functional characteristics (Kerckhoffs *et al.*, 2002; Lafta, 2019).

Studies indicate that most of the 70% of the lipidst acids found in cow milk are saturated oral acids represented by lauric, myristic, and balmic acid, which are particularly responsible for atherosclerosis (McSweeney & Fox, 2013; Al-Barazini & Zainal., 2023). Lipidss play an important role in food, and they are the main contributors to the flavor, quality of texture and consistency, and reducing the percentage of lipids or lipids while maintaining the sensory quality and consistency is the biggest challenge in food production (Wu *et al.*, 2013; Guinee & McSweeney, 2006). Therefore, modern studies are directed towards the addition of some substances as substitutes for lipidss, which are called lipids mimetic, which work to improve the rheological properties of the products, as the substitutes for lipidss have a chemical composition different from the chemical composition of the mouth, but they have physical properties similar to the mouth, when added to food products, they give a soft texture. And the creamy taste in the mouth and the viscosity that fits the quality of the factory product (F S N, 2014).

Oligo- and polysaccharides that are digestible or indigestible are considered as good sources of lipids substitutes, carbohydrates that are not digested by human enzymes in the small intestine may be used well as oral substitutes in the production of functional foods (Sikorski *et al.*, 2008; Rasheed, & Al Nuaimmi, 2022). Grains contain different types of soluble fiber and insoluble fiber, such as carrageenan, and are in the form of water-loving colloids, and are highly viscous in nature, and are fermented in the intestines before intestinal germination, so they are considered good sources for food production (Ostman *et al.*, 2006). According to the recent trends in the employment of lipids substitutes in the dairy industry, they have interesting sensory properties due to their functional properties as well as nutritional properties; some of them contain a high percentage of bioactive compounds, in addition to being active in reducing energy and obtaining healthy products. Strengthening the immune system and reducing total cholesterol (Vidigal *et al.*, 2014). Carrageenan consists of a group of



galactan polysaccharides extracted from red seaweeds of the Gigartinaceae, Solieriaceae, and Phyllophoraceae (Solieriaceae) families. The three principal types are referred to as kappa, iota, and lambda; they differ from one another principally in amount of ester sulphate, the position of the ester sulphate groups, and their 3,6 anhydro-d-galactose.

Kappa-carrageenan is composed of alternating 1,3-linked galactose 4-sulfate and 1,4-linked 3,6 anhydro-d-galactose residues. It is most sensitive to K⁺ ions, in the presence of which it can form rigid, thermally reversible aqueous gels its Molecular Weight: 788.647 Dalton. (Lafta,2018) . Therefore, the current study was conducted and its purpose was to employ oil substitutes. The representation of the statement of the effect of replacing the milk prepared for the production of Kashkawan cheese with the above-mentioned replacement of the milk by studying the nutritional and physiological effects of this product.

MATERIALS AND METHODS

In this study, 48 male BALB/C white albino mice were used its weight 30 ± 4 g, obtained from the National Center for Pharmaceutical Research and Control, Baghdad, Iraq. The life of the mice used in the experiment was about 4 weeks, and the effect of adding K-Carrageen (from Fooding Company / Chaina) on the sugar level, triglyceride levels, and total cholesterol, lipoproteins (HDL, LDL and VLDL). The number of white blood cells, , the phagocytosis factor, the concentration of the cytokine interferon-Kama, the liver enzymes GOT, GPT, Alkaline phosphatase levels were examined in the study. The animals were housed in controlled environments with regulated ventilation and a temperature maintained at $25 \pm 2^\circ\text{C}$, while experiencing a light cycle of 12 h. of darkness followed by 12 h. of light. The mice were divided into four groups based on their dietary intake. They were kept in specialized plastic cages and provided with food and distilled water, which were continuously available to them (ad libitum). The food was placed in the cages three days prior to the start of the experiment to allow the mice to acclimate to their new surroundings. Throughout the week of the experiment, the weight of the animals and the amount of food consumed by each group were recorded in table (1).

Table (1): Components and proportions of the main ingredients used for feeding mice (g/100g)

Components	Group1 (g/100g)	Group2 (g/100g)	Group3 (g/100g)
casein	20	20	20
corn oil	7	7	7
Cellulosic fibers	5	5	5
mix of vitamins	1	1	1
mix of minerals	3.5	3.5	3.5
Colin	0.2	0.2	0.2
Corn starch	46.8	46.8	46.8
Type of cheese	50% lipids+ 50% Kashkawan cheese from full-fat milk	50% lipids+ 50% Kashkawan cheese from skim milk	50% lipids + 50%, Kashkawan cheese added to K-Carrageen at a rate of 0.2% from skim milk



Preparation of rat feeding solution

The food of the mice (Table, 1) has prepared according to the nutritional and physiological requirements (AIN, 1993).

Sample collection:

At the conclusion of the experiment, the mice underwent a fasting period of about 8 hours. They were then anesthetized with chloroform, and blood samples were obtained through cardiac puncture, where blood was drawn directly from the heart using a sterile medical syringe. The collected blood was transferred into dry, sterile test tubes and separated into two portions:

The first (Plasma): I added heparin to prevent clotting and used this blood for cellular immunity experiments.

The second (serum): leave the blood to cool in the refrigerator for 30 minutes, then collect the serum blood after the central extraction at a speed of 2000 rpm/min. for 10 min.

Split the serum into smaller portions using Ebendorf tubes and store them at -20°C until needed. The Pasteur pipette can be used immediately or stored in a deep freeze to maintain its integrity and prevent contamination from bacteria and fungi.

Biochemical Analysis

Estimation of Serum Glucose Level according to the method **Bablock *et al.* (1988)**, created by me prior to the German company (Human) and in accordance with the company's guidelines. Determine the glucose concentration in 100 ml of serum using the following equation:

Concentration of glucose (mg / 100 ml) = absorbance reading of the sample/ absorbance reading of the standard solution X (100) concentration of the standard solution

Determination of Glutamate Oxaloacetate Transaminase (GOT) and Glutamate Pyruvate Transaminase (GPT) activity

Follow the color method used by (**Thefeld *et al.* 1994**) and developed by (AGAPPE) company and according to the instructions of provided company. Enzyme efficiency can be calculated in the universal unit/ liter (U / L) depending on the following equation:

The activity of GPT enzyme (unit/liter) = Absorption rate/number of minutes× 1745

GOT enzyme activity (units/liter) = Absorption rate/number of minutes × 1745

Measurement of Alkaline phosphatase enzyme level in mice serum

It follows the color method **Schlebusch *et al.* (1974)** and it was developed by (AGAPPE) company and according to the instructions of provided company.

Estimation of serum total total cholesterol level

It is measured according to the method of enzymatic decomposition of total cholesterol according to the method of **Young (1995)** that developed (Human company) and according to the instructions of the company. According to the following equation:



Total cholesterol concentration (mg/ 100 ml) = absorbance reading of the sample/ absorbance reading of the standard solution X 200 concentration of the standard solution

Estimation of Serum Triglycerides Level

It is measured by follow the method of enzymatic decomposition of total cholesterol according to the method (Young, 1995) developed by (Human) German company and according to the instructions of the company. According to the following equation:

Concentration of ternary alkaloids (mg/100) = absorbance reading of the model/ absorbance reading of the standard solution X (200) concentration of the standard solution

Estimation of Serum HDL lipids Level

We utilize the enzymatic decomposition method for measuring High-Density Lipoprotein (HDL) total cholesterol, as outlined by **Burstein (1970)** and developed by a German company, Human. This process is conducted in accordance with the company's guidelines. To determine the concentration of HDL lipids in 100 ml of my serum, we apply the following equation: **HDL LIPIDS concentration (mg/ 100 ml) = absorbance reading of the model/ absorbance reading of the standard solution X (50) concentration of the standard solution X (2).**

Estimation of Serum LDL and VLDL Level

The measurement of the total level of LDL and VLDL through Freid's mathematical equation as mentioned (**Al-Sharfani, 2006**) is as follows:

Triglyceride/ 5] -[HDL LIPIDS LIPIDS-C]- [LDL_Cholestrol]

[Triglyceride / 5] = [VLDL- Cholestrol]

Measurement of INF- γ concentration level by ELISA test

For this purpose, we used the diagnostic kit manufactured by (Abcam American company), and the reagents were stored at room temperature before use to ensure homogeneity. The process of calculating the concentration by drawing a standard curve (Standard Curve) and measuring the absorption value to find out the concentration of INF - γ pg/ml. And the figure (1) of the standard curve in the Elisa test is explained.

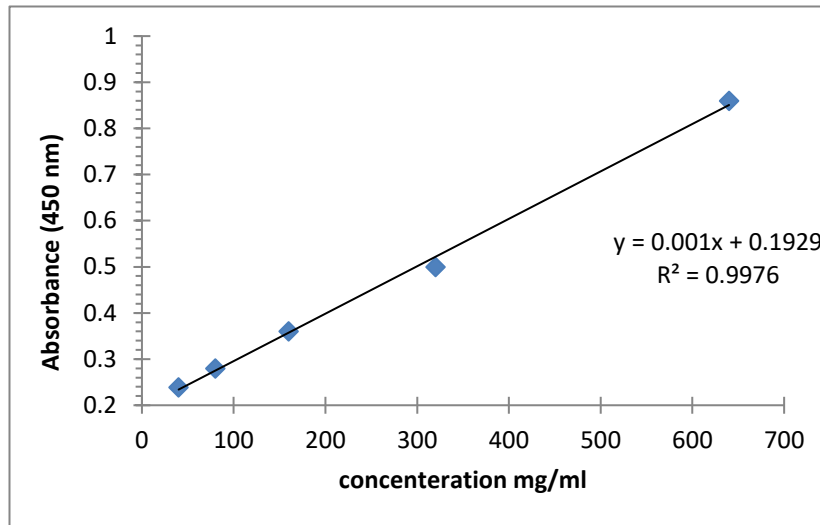


Figure (1): standard curve to estimate the concentration of INF- γ

Examination of phagocytosis

The reliability of the method (Haen, 1995) and the strength of the number of phagocytes according to the following equation:

The phagocytic index (P.I.) % = the number of phagocytic cells/ the total number of phagocytic cells $\times$ 100

Blood tests

Total leukocyte count estimation was measured according to the method (Haen, 1995) in estimating the number of alcoholic white blood cells.

The total number of white blood cells (cell/ml) = the number of cells counted / 4 x 20 x 10

Absolute Count of Leukocyte was measured according to (Haen, 1995) in estimating the number of white blood cells.

Alcohol number of cells (cells/ml) = percentage of each cell X alcohol number/100

Statistical analysis

The data was analyzed according to the complete random design (CRD) in the analysis of the effect of transactions. The differences in the studied attributes and the correlation of the spiritual differences between the means by the test of least significant difference (LSD) at 0.05 and using the advanced statistical analysis software (SAS, 2018).

RESULTS AND DISCUSSIONS

Studying the effect of K-Carrageen on average weight of mice

The results showed that the effect of feeding with standard weight by 50% plus 50% high-fat Kashkawan cheese, and this treatment is the positive control treatment C+, but the



negative control treatment is C- feeding on standard weight by 50% +50% of my modified Kashkawan cheese. Milled milk without any additions and A1 treatment, nutrition on a standard basis, 50% + 50% Kashkawan cheese from milk added to K-Carrageen and at a rate of 0.2% in the average daily increase and final weight gain among the total of experimental animals after 28 days (Table 2).

It is clear from the results that the daily weight of control group reached 0.2438 g/day and the final weight is 6.829 g. The results also show that the highest weight gain of this treatment is the highest weight gain of this treatment, which is fed on the standard lipids and full-fat Kashkawan cheese.

Table (2): The rate of increase in weight for the total number of different treatments after 28 days.

Treatments	Body weight (g)		The increase or decrease in body weight after 28 days (g)	The average daily increase in body weight (g)
	Primary Weight	last Weight		
Control C+	30.403	37.232	6.829	0.2438
Control C-	30.283	36.823	6.540	0.2335
A1	30.344	34.045	3.701	0.1321
LSD	3.182NS	* 2.061	* 2.579	* 0.094

For the group of rats fed on a diet with a high oral content, the average daily weight gain of the group fed on a standard diet with Kashkawan cheese from milk is only 0.2335 g and the final weight is 6.540 g. As for the last group fed on standard basis with Kashkawan cheese from milk added to K-Carrageen and at a rate of 0.2%, The daily weight recorded was 0.1321 g, while the final weight was 3.701 g. A comparison of these results reveals that the positive control treatment had the highest weight, followed by the negative control treatment, with the A1 treatment coming in last.. This is in agreement with our findings (Trautwein *et al.*, 1998) and the lack of effect on the weight of mice fed on a lipids-rich diet containing (alternative) even in the high increases of mine which were 8.0, 12.0, 16.0%, which contributed to the limit of weight. The reason for this is due to the presence of dietary fibers, especially cellulose, in the surrounding of nutrients, especially lipids, and reducing the absorption and excretion of the largest amount of them with waste, in addition to increasing the moisture content of food, reducing the duration of its stay in the digestive tract, and facilitating the excretion of feces, which reduces the chances of absorption of lipids.

(Lopez-Gusia *et al.*, 1988; Lafta, 2018) found that eating food containing fiber leads to a feeling of satiety, which reduces the amount of digested food and thus reduces the energy available to the body, which leads to weight loss. Also, these results are in agreement with (Al-Hasni, 2007), who found that feeding mice with lipids substitutes at a rate of 5 and 10% contributes significantly to reducing the weight of these mice compared to the control treatment. When comparing the average increase in the total weights of the transactions



supported by lipids substitutes compared to the rest of the transactions, we find that the least weight increase was in the A1 group, which was fed on a standard basis with Kashkawan cheese, added to the carrageenan, and the negative control group.

K-Carrageen is also a low-energy carbohydrate that does not absorb in the small intestine, so it does not cause obesity, and it is fermented by the beneficial and therapeutic bacteria in the large intestine, so it does not play a role in diabetes, and it is recommended to use it in low-sugar foods as an alternative (**Abou-zeid, 2016**). The results indicated no significant differences ($P < 0.05$) in the weights of the treated rats during the adaptation period. However, there were significant differences observed in both daily weight gain and the rate of daily weight gain among the positive control treatment, negative control treatment, and A1 treatment.

The effect of lipid substitutes on the level of total cholesterol, triglycerides, HDL LIPIDS, LDL and VLDL

It is clear from the table (3) that the high total cholesterol value for the positive control treatment is 152.16mg/100ml due to the high oral content compared to the negative control treatment which is 141.56mg/100ml. Alcoholic total cholesterol and LDL and VLDL. The triple and low HDL LIPIDS LIPIDS in the group of rats fed on high lipids diet. The liver is the main organ responsible for the synthesis of total cholesterol and its balance in the body, and the total cholesterol content in the liver always corresponds to the total cholesterol levels in the liver, that is, when the total cholesterol levels in the liver increase, the total cholesterol content in the liver is also high (**Abou-Zeid, 2016**). However, the value of total cholesterol for the treatment A1 decreased significantly compared to the positive and negative control treatment, it reached 131.67mg/100ml, and this is in agreement with (**Al-Hasni, 2007; Abou-Zeid, 2016**). K-Carrageen reduces total cholesterol levels during the promotion of bile salts, the amount of total cholesterol converted to salts increases.

The decrease in total cholesterol value for treatment A1 compared to the positive and negative control treatment, due to the presence of K-Carrageen used in the made of Kashkawan cheese, this treatment is in agreement with (**AL-Rawashdeh, 1997**), who indicated a significant decrease in total cholesterol level in the treatment of laboratory mice fed on supplemented with aniline lipids substitute compared to the control treatment. (**Al-Adhari, 2008; Lafta, 2018**) attributed this decrease to the occurrence of anaerobic fermentation in the colon for dietary fiber, resulting in short-chain acids such as and propionic acid, which have the effect of inhibiting total cholesterol-forming enzymes in the liver, and hindering the absorption of lipids and bile salts from the digestive tract and because of the high viscosity of the fibers.



Table (3): total cholesterol, triglycerides, HDL LIPIDS LIPIDS, LDL, and VLDL levels for total animals of different treatments after 28 days.

Treatments	Total cholesterol (mg/100 ml)	Triglycerides (mg/100 ml)	HDL LIPIDS LIPIDS (mg/100 ml)	LDL (mg/100 ml)	VLDL (mg/100 ml)
Control C+	152.16	146.85	67.96	53.63	29.37
Control C-	143.56	136.73	69.41	45.40	27.34
A1	131.67	109.61	74.00	32.60	21.92
LSD	36.75NS	* 29.52	* 7.026	* 12.64	* 5.88

The value of TG for positive control and negative control and A1, it was 146.85, 136.73 and 109.61 mg/100 ml respectively. It is noted that these values are high for the positive control treatment due to the high oral content of the product from mozzarella cheese manufactured with full-lipids milk, and it is also noted that these values are lower for the treatment of Kashkawan cheese fortified with K-Carrageen compared to the positive control treatment as well as the negative control treatment in which the value of triglycerides increased compared to treatment A1. This is in agreement with (Al-Hasani, 2007) Researchers discovered that incorporating a lipid substitute (betaclocan) derived from millet into the diet of mice resulted in a reduction in total cholesterol and triglyceride levels associated with alcohol.

Kofuji et al., (2012) The reduction in triglyceride levels was attributed to a decrease in lipid synthesis in the liver, achieved by inhibiting liver function and decreasing the activity of enzymes that promote lipid production. Also, the decrease of triglycerides is related to the increase in the metabolism of rich lipoproteins, in addition to this, insulin and glucose levels are an important step in the process of regulating lipids acids and triglycerides. **Delzenne et al., (1995)** pointed out that the guarantee of bad breath (aniolin) to mice food is high in the content of saturated lipids, and in a spiritual sense, the content of blood and liver in triglycerides is reduced. It also agrees with **AL- Rawashdeh, (1997); Al-Shorfani, (2006)** who mentioned that the addition of aniline to the diet of rats contributes to the reduction of alcoholic total cholesterol and triglycerides in fed rats. **Kaur et al., (1989)** attributed the decrease in the level of triglycerides to the effect of aniulin in reducing the secretion of VLDL from the liver as a result of reducing the activity of the enzymes produced in the mouth, and it also changes the alginic expression of the lipids acid synthesis enzyme.

The results note that the absence of significant differences between your coefficients A1 and A2, which reinforces the important role played by lipid substitutes in reducing triglycerides. However, for the amount of high-density lipoproteins, HDL LIPIDS for positive control and negative control and A1, it was 67.96, 69.41 and 74.00 mg/100 ml respectively. The results showed that there is a significant difference in HDL LIPIDS values between the treatment of positive control and the treatment of negative control. It is observed that the value of these lipoproteins is lower in the negative control treatment compared to the positive control treatment, which causes an increase in the weight of the people in this group. This is in agreement with (**Kok et al., 1996**), which indicates that the weight gain of the experimental animals is related to the decrease in HDL LIPIDS level. Therefore, it is observed that the height of the final weights of the people of the positive control group and their weight gain and



the decrease in the value of HDL LIPIDS LIPIDS good lipids in them compared to the negative control treatment.

This aligns with the findings of **Kalaivanisailaja et al., (2003)**, **Saeed et al., (2023)** and **Mahdi et al. (2023)**, who noted a reduction in HDL lipids, the beneficial lipids, in the plasma of rats consuming a high oral content diet. They suggested that this decrease is linked to reduced activity of the enzyme lipoprotein lipase and total cholesterol lecithin. Additionally, it was observed that the HDL lipid levels were higher in treatment A1, which included Kashkawan cheese and carrageenan, compared to both the positive and negative control treatments. But the value of LDL for positive control, negative control, and A1 treatment was 53.63, 45.40, and 32.60 mg/100 ml, respectively. He also observes the decrease of these values for the two transactions A1, the interests of Kashkawan cheese. This is a good indicator of the effect of these additives, as LDL is one of the bad lipids in the blood, as the high levels pose health risks. But the value of VLDL for positive control, negative control, and A1 treatment was 29.37, 27.34, and 21.92 mg/100 ml respectively.

They also notice the high value of this value for the positive control treatment compared to the negative control treatment. However, these values are lower for treatment A1, which is fed on Kashkawan cheese plus lipids substitutes represented by carrageenan, compared to positive and negative treatment. This is in agreement with (**Kalaivanisailaja, et al., 2003**) who indicated a significant decrease in the level of triglycerides and VLDL when using aniline lipids substitute in the feeding of rats, and stated that the reason for this is that aniline reduces the activity of liver enzymes responsible for building lipids especially the enzyme glycerol-3-phosphateacyltransferase, as well as reducing the capacity of the liver to synthesize.

The high level of alcohol total cholesterol, LDL, VLDL and triglycerides, rich in lipids, is directly responsible for the occurrence of obesity in people of this group and other disorders related to the diet (**Kok et al., 1996; Al-Badri, 2016**). Therefore, the significance of the three lipid substitutes in preventing excessive weight gain, keeping lipid and total alcohol cholesterol levels within normal ranges, increasing the proportion of beneficial lipoproteins (HDL), and lowering the levels of harmful lipoproteins (LDL and VLDL) is clearly highlighted.

The effect of lipids on the level of glucose and liver enzymes GOT, GPT, ALP and Immune InfY protein in mice:

Table (4) shows the statistical difference of the effect of mice added to Kashkawan cheese with full lipids milk (positive control treatment) and my factory mozzarella cheese with milled milk only and Kashkawan cheese with milled milk added to carrageenan on the blood glucose level between the groups of rats after review 28 days. According to the results, the highest concentration of glucose in the whey of the pigs treated with the positive control group fed with full-lipids mozzarella cheese was 124.16 mg/100 ml, compared to the negative control group fed with the standard Kashkawan cheese of the milk was 119.54 mg/100 ml. Then, the group of rats treated with A1, which was fed with the addition of cheese from the factory, with the addition of K-Carrageen as an oral substitute, was 74.41 mg/100 ml, which is significantly less than the ratio in the positive control group as well as the negative control, and the results of the statistical analysis show that there are significant differences ($P < 0.05$) in the percentage



of glucose between the positive control treatment and your A1 treatment and the control treatment A1.

Miller et al., (1977) mentioned that the cause of low blood sugar is due to the effect of short chain lipidsty acids (SCFA) on the absorption of glucose, during the regulation of hepatic glucose and the regulation of lipid metabolism, and that the effect of aniline added to food in reducing sugar It may be related to glucose levels. The results showed that the effect of adding manufactured Kashkawan cheese with lipids substitutes on the level of liver enzymes among the mice after 28 days. Liver enzymes GOT, GPT, and ALP are among the sensitive indicators for detecting many diseases, including heart diseases, liver damage, or high inflammation levels in the body, as these diseases lead to increased secretions (Table 4). The record of the highest concentration of Glutamateoxaloacetatetransaminase (GOT) in the serum of the positive control treatment group was 54.27 units/L compared to the negative control treatment group. It was 50.67 units/L, then including the A1 treatment group was 46.02 units/L, which is a significant decrease compared to the control treatment group.

There are significant differences ($P < 0.05$) in GOT concentration between the groups. These indicators show that lipids substitutes play a big role in reducing the levels of this enzyme and falsely within the normal level. As for Glutamatepyruvate transaminase (GPT) enzyme had the highest concentration in the serum of the group of rats in the treatment of the positive control, fed with the addition of high-lipids Kashkawan cheese, which was 86.7 units/L. However, the concentration in the rats of the negative group is 79.5 units/L, which is less compared to the concentration in the rats of the A1 group, but the concentration in the tail of the rats treated with A2 was 69.3 units/L, and this value is less and significantly different from the value in the rats treated with the positive control (Table 4).

The results of the statistical analysis indicate the existence of significant differences in the concentration of GPT between the positive control treatment and the A1 treatment, which reinforces the vital role of these additives in maintaining liver functions and maintaining normal levels. Also, the highest concentration of Alkalinephosphatase (ALP) enzyme was recorded in the serum of the positive control treatment group was 109.6 units/L. However, the concentration in the mice of the negative control treatment was 99.6 units/L, which is lower than that of the mice of the positive control group, while the concentration in the mice of the A1 treatment was 55.3 units/L. The results show a decrease in the concentration of ALP enzyme for both treatments that contain Kashkawan cheese manufactured with lipids replacement compared to the positive control group.

Table (4): Levels of glucose, liver enzymes, and interferon-kuma-kuma –kama for all rats of different treatments after 28 days.

Treatments	Glucose (mg/100 ml)	GOT (unit/L)	GPT (unit/L)	ALP (unit/L)	InfY (pg/ml)	Phagocytic index%
Control C+	124.16	54.27	86.7	109.6	54.8	51.3
Control C-	119.54	50.67	79.5	99.6	56.4	54.8
A1	74.41	46.02	69.3	55.3	63.8	69.9
LSD	* 39.21	* 8.44	* 13.62	* 22.86	* 7.59	* 11.72



The value of interferon-kuma, it recorded the lowest concentration was in the group of rats treated with the positive control, which was 54.8 pg/ml, which is clearly lower compared to the value of the negative control treatment, which was 56.4 pg/ml, but the concentration of interferon-kuma was for the rats treated with A1, fed on the supplement with Kashkawan cheese. This is in agreement with the findings of (Sone *et al.*, 1992), who noted the high concentration of interferon-kuma in the stomach when feeding sheep on a diet containing carrageenan, as well as in agreement with (Li *et al.*, 2005), who pointed out that the strengthening of the diet with carrageenan contributes to the increase of interferon-kuma in the stomach. It is a high value compared to the transaction Positive control and this is in agreement with our opinion (Khalkhane *et al.*, 2013), who pointed out that lipid substitutes and fructooligosaccharides are capable of increasing interferon-kuma production.

The results showed that there is a significant difference in the concentration of InfY between the treatment of positive control and treatment A1 and the treatment of negative control and treatment A1, and this highlights the role of lipid substitutes in strengthening the immune system. These results are in agreement with (Harada *et al.*, 2002 & Ibrahim, 2014), which observed an increase in the ability of cells to infect the killed yeast with an increase in the concentration of lipids substitutes in the alimentary tract.

CONCLUSIONS

The study concludes that incorporating lipid mimetics of K-Carrageenan at a concentration of 0.2% can enhance the performance of these lipid mimetics in various feeding and health indicators. The addition of lipid mimetics resulted in a decrease in the daily weight gain of the experimental animals, as well as lower levels of total cholesterol, triglycerides, and harmful lipids such as LDL and VLDL. Conversely, it led to an increase in beneficial HDL lipids. Additionally, lipid mimetics contributed to a reduction in blood sugar levels and improved the efficacy of liver enzymes, including GOT, GPT, and ALP.

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