Abstract: Fortified milk containing Lactobacillus plantarum, L. casei, and L. acidophilus isolates and their mixture were used in dosing the male albino rats at an age of 9-12 weeks at an average of 23 g with induced hypothyroidism at a concentration of 0.6 g.kg⁻¹ of carbimazole. Total cholesterol, triglycerides, high-density lipoprotein (HDL), low-density lipoprotein (LDL), and very-low-density lipoprotein (VLDL) were estimated. The results showed a significant increase in the level of triglycerides (TG), cholesterol and triglycerides. Low-density lipoprotein (LDL) and very-low-density lipoprotein (VLDL), with a significant decrease in the level of high-density lipoprotein (HDL) in infected male mice, compared to the control sample, and upon dosing with liquid milk fortified, it returned to its normal level without significant differences from the control group.

Keywords: Carbimazole, Lactic acid bacteria, Hypothyroidism.

Introduction

The World Health Organization (WHO) indicated that cardiovascular diseases would affect about 3.3 million people by the year 2030 by all over the world (Saxena et al., 2013) and confirmed that 17.5 million people lost their lives due to cardiovascular diseases and this represents about 31% of all global deaths. The volume of cardiovascular disease continues worldwide, and heart disease affects three times more in people with high cholesterol levels compared to normal people (Nichols et al., 2013). Medicines and chemical treatments have been used as a means to control the level of cholesterol in the blood but may cause potential and unwanted side effects such as digestive discomfort (Wang et al., 2010; Kumar et al., 2012). Functional foods and nutrients have recently received more attention in lowering cholesterol level in the blood (Bartley et al., 2010) and in the past decade, lactic acid bacteria have been confirmed (Wang et al., 2010), where they have been carried out in vivo and laboratory experiments. To verify
the effect of lactic acid bacteria on lowering the level of fats and cholesterol (Ding et al., 2017; Pavli et al., 2018). Where lactic acid bacteria reduce cholesterol (Gaudana et al., 2010).

Therefore, this study aimed to find out the effect of using Fortified milk by some strains of *Lactobacillus* ( *L. plantarium*, *L. casei* and *L. acidophilus*) and their mixture in reducing the level of fats and cholesterol in male rats with hypothyroidism induced by carbimazole.

**Materials & Methods**

**Design the experiment**

The experiment was carried out in the laboratory of the Department of Food Science in the Faculty of Agriculture at the University of Basrah for the period During April 2019, including a 14-day acclimatization period.

**Experiment animals**

In this study, using 117 male rats. Their ages ranged from 9 to 12 weeks and the weight ranged from 23 to 25 g. The animals were distributed in plastic cages covered with metal sheets and furnished with sawdust, as the mulch was changed every four days. The cages were placed in the laboratory at a temperature from 22 to 28 °C and a lighting system 12 hours from lighting. The animals were provided with water and feed as in the table (1) manufactured according to the Subcommittee of Laboratory Animal Nutrition (AIN93) Reeves (1996) method. This procedure continued for up to two weeks as an acclimatization period.

### Table (1): The rat's food ingredients

| Materials          | Quantities (g.kg⁻¹) |
|--------------------|----------------------|
| Skim Milk          | 200                  |
| Corn Starch        | 670                  |
| Vitamins and minerals | 30              |
| Corn oil           | 50 ml                |
| Cellulose          | 50                   |

**Experience design**

The experimental animals were divided into 9 groups, with 13 rats per group:

- **Negative control group**: (T1) A control group was given water and diet only.

- **The second group (T2)**: Positive control group: the diet and water containing carbimazole 0.6 g.kg⁻¹ were given to induce thyroid atrophy.

- **The third group (T3)**: were given feed and water containing carbimazole and milk products containing *L. acidophilus*.

- **The fourth group (T4)** were given feed and water containing carbimazole and milk product containing *L. plantarium* bacteria.

- **The fifth group (T5)** were given feed and water containing carbimazole and milk product containing *L. casei* bacteria.

- **Sixth group (T6)** were given feed and water containing carbimazole, *L. acidophilus*, and *L. plantarium*.

- **The seventh group (T7)** were given feed and water containing carbimazole and milk product containing *L. plantarium* and *L. casei*.

- **The eighth group (T8)** were given feed and water containing carbimazole and milk...
product containing *L. acidophilus* and *L. casei*.

Group IX (T9) were given feed and water containing carbimazole and lactic product containing *L. acidophilus*, *L. casei*, and *L. plantrum*.

**Collect blood samples**

Blood was drawn from the heart using 5 ml medical syringes in plastic anticoagulant-free tubes for biochemical tests. The serum was separated with a centrifuge at 4000 rpm for 10 minutes and then the serum was separated by a micropipette. Divide the serum in several clean and sterile tubes and kept it frozen at -18°C until the biochemical tests are performed.

**Estimation of total cholesterol concentration**

The serum cholesterol concentration was estimated using a kit equipped by the French company, Biolab technical support and analyzes were performed according to the instructions provided by the supplied company by reading the samples with a spectrophotometer at a wavelength of 505 nm and according to the following formula:

\[
\text{cholesterol mg. 100. cm}^{-3} = \frac{\text{sample read}}{\text{standard solution read}} \times 200
\]

**Determination of triglycerides in serum**

The concentration of triglycerides in the blood serum was estimated according to the method attached with the kit prepared by the Tunisian Biomagaghreb company, which depends on the enzymatic degradation of the triglyceride and based on the formation of the quinonemine compound as a result of the hydrolysis of the TC in an enzymatic form with a red pigment, the intensity of which increases with the increase in the concentration of the triglycerides according to the following equation:

\[
\text{Concentration of triglycerides (mg. 100ml}^{-1}) = \frac{\text{sample read}}{\text{standard solution read}} \times a
\]

\[a = \text{Concentration of standard solution 200 mg.100}^{-1} \text{ ml}\]

**Determination of HDL concentration for cholesterol in serum**

The HDL concentration was estimated using the ready-made kit mentioned in the determination of cholesterol and was measured using an optical spectrophotometer at a wavelength of 500 nm and according to the following formula:

\[
\text{HDL concentration (mg. 100ml}^{-1}) = \frac{\text{Sample absorbance}}{\text{standard solution absorbency}} \times n
\]

\[n = \text{concentration of the standard solution 200 mg.dL}^{-1}\]

**Determination of the concentration of the low-density lipoprotein level for cholesterol in serum**

Estimate according to the following equation:

\[
\text{LDL} - C \text{ mg. dl}^{-1} = \text{Total cholesterol} - (\text{HDL} + \text{VLDL})
\]

**Determination of the very low-density lipoprotein concentration of cholesterol in serum**

The value of VLDL-C was calculated by the following equation and by the method Burtis *et al.* (2012).
VLDL mg dl⁻¹ = Triglycerides / 5

**Statistical analysis**

The data were analyzed statistically according to the complete random design (CRD), and the lowest significant difference was used to compare the averages using the available statistical analysis program (SAS) (SAS, 1990).

**Results & Discussion**

**Cholesterol:**

The results of the table (2) showed a significant increase in the level of cholesterol in the group of rats with hypothyroidism induced by the action of caramidazole, as the average reached 87.6 mg.kg⁻¹ compared with the control group whose average cholesterol in the serum of its individuals reached 57.5 mg.kg⁻¹. Hepatocytes are the reason for reducing cholesterol release in the duodenum or the reason may be due to the blockage of the hepatic duct due to the effect of carbimazole and this caused the suspension or reduction of cholesterol release to the duodenum which confirmed Kalender et al. (2010) an increase in cholesterol concentration in rats with thyroid images as a result of administering malathion at a concentration of 1.28 mg.kg⁻¹ of body weight with drinking water for four weeks. The results of the study were consistent with that confirmed by Ismail (2013) who observed elevated cholesterol levels in groups of hypothyroid rats. The reason is attributed to the production of lactic acid bacteria, hydroxyl menthyl glutarate during fermentation, which reduces cholesterol synthesis by inhibiting this compound Hydroxyl menthyl glutarate CoA-reductase necessary in the synthesis process or the ability of the bacteria to convert cholesterol into non-absorbable coprostanol and cholestanols and excrete them with feces. Hence lowering total cholesterol levels (Kumar et al., 2012).

**Table (2) Effect of lactic product fortified with lactic acid bacteria on cholesterol in male rats with carbimizole-induced hypothyroidism (mean ± standard error).**

| Treatments | Cholesterol concentration (mg.100cm⁻³) |
|------------|----------------------------------------|
| T1         | 57.50a ± 0.760                         |
| T2         | 87.60b ± 0.858                         |
| T3         | 76.01c ± 0.634                         |
| T4         | 60.00d ± 1.320                         |
| T5         | 59.70d ± 0.801                         |
| T6         | 70.00e ± 0.853                         |
| T7         | 58.11f ± 0.551                         |
| T8         | 56.50d ± 0.591                         |
| T9         | 55.92al ± 0.998                        |

Means in the same vertically with different letters show significant differences (P<0.05).

**Triglycerides:**

The results of the table (3) exhibited a significant increase in the number of triglycerides in T2 group rats with an average of 94.8 compared to the control group in which the average was 62.2. The cause of elevated triglyceride levels may be due to the low level of secretion of thyroid hormones that perform the function of lipolysis and then put it in bile; or it may be due to hypothyroidism leading to a loss of the efficacy of the lipoprotein lipase enzyme located in the lining of the capillary blood vessels, which works to break down triglycerides, so the ineffectiveness of this
enzyme prevents the removal of TG; this increases its concentration in the blood (Abbas et al., 2008). It is also noted from the results of the table that a significant decrease (P <0.05) was observed in the number of triglycerides when dosing experimental rats with the milk product containing lactic acid bacteria compared to the infected rats with a significant superiority of L. casei and L. planetarum and their mixture as averages 64, 65 and 65 respectively. The reason for the decline may be attributed to the fact that the lactic acid bacteria act to stimulate the lipase enzyme responsible for the decomposition of triglycerides and thus their quantity; or bacteria can stimulate the secretion of bile acid from liver cells, which works to inhibit the absorption of cholesterol and triglycerides from the intestine and thus excrete it with excreta (Abdullah et al., 2013).

Table (3): Effect of lactic product fortified with lactic acid bacteria on triglycerides in male rats with carbimazole-induced hypothyroidism (mean ± standard error).

| Treatments | Triglycerides concentration (mg.100cm⁻¹) |
|------------|-----------------------------------------|
| T1         | 62.20 ± 0.665                           |
| T2         | 94.80 ± 1.029                           |
| T3         | 81.75 ± 0.750                           |
| T4         | 64.33 ± 0.712                           |
| T5         | 63.91 ± 0.566                           |
| T6         | 72.38 ± 0.545                           |
| T7         | 63.8 ± 0.530                            |
| T8         | 71.05 ± 0.238                           |
| T9         | 70.00 ± 0.364                           |

Means in the same vertically with different letters show significant differences (P<0.05).

High-density lipoprotein:
The results of table (4) displayed that the average amount of high-density lipoprotein in the serum of the negative control group rats was 48.2 mg.kg⁻¹ decreased to 28.1 mg.kg⁻¹ in the serum of the rats of the positive control group with hypothyroidism due to the effect of carbimazole on the permeability of membranes. Hepatic cells or bile duct obstruction, which causes cholesterol to be reduced or released into the duodenum, or due to inhibition of the enzyme Butyrlcholinessterase, which performs the function of metabolism of fats and lipoproteins (Kalender et al., 2010).

Table (4): Effect of lactic product fortified with lactic acid bacteria on HDL in male rats with carbimazole-induced hypothyroidism (mean ± standard error).

| Treatments | High Density Lipoprotein concentration (mg.100cm⁻¹) |
|------------|---------------------------------------------------|
| T1         | 48.20 ± 0.234                                     |
| T2         | 28.10 ± 0.188                                     |
| T3         | 32.42 ± 0.556                                     |
| T4         | 44.45 ± 0.841                                     |
| T5         | 45.02 ± 0.612                                     |
| T6         | 36.66 ± 0.575                                     |
| T7         | 46.20 ± 0.402                                     |
| T8         | 30.00 ± 0.777                                     |
| T9         | 33.81 ± 1.056                                     |

Means in the same vertically with different letters show significant differences (P<0.05)

HDL increased again when the rats were dosed with the lactic product containing L. acidophilus, L. casei and L. planetarium, to reach 32, 44 and 45 mg.kg⁻¹ respectively, and reached the highest average of 46 mg. kg⁻¹ when the rats were dosed with the Fortified milk with a mixture of lactic acid bacteria.
The high level of HDL may be caused by the bacteria *L. plantarum* and *L. casei*, which reduce cholesterol absorption. It is a positive sign for preventing atherosclerosis and reducing the risk of coronary heart disease (El-Shafie et al., 2009).

**Low-density lipoprotein:**

It is noted from the results of the table (5) that the mean amount of LDL in the serum of control group rats was 35.4 mg.kg\(^{-1}\), the level increased to 63.1 mg.kg\(^{-1}\) in the group T2 and the reason may be attributed to that it is also noted from the table that the level of LDL decreased again to 55 mg.kg\(^{-1}\) when the rats were dosed with the lactic product containing *L. acidophilus* and the effect of the addition of bacteria was *L. plantarium* and *L. casei* were most effective and at a significant level (P <0.05) in reducing the level of LDL in the rat blood serum where the average was 38 and 37 mg.kg\(^{-1}\), respectively, and the mean amount of LDL 50 and 51 mg.kg\(^{-1}\) when dosing the milky product rats containing a mixture of *L. plantarium*, and *L. casei* and *L. acidophilus*, respectively. The lowest mean LDL was 36 mg.kg\(^{-1}\) when administered with the mixture of *L. casei* and *L. plantarium*. The cause of the harmful LDL level decline may be attributed to the effect of the decrease in the lactic acid bacteria in the fatty acid metabolism, thereby reducing VLDL-C in the liver and a decrease in the formation of LDL in the bloodstream. (Abdullah et al., 2013).

**Table (5): Effect of lactic product fortified with lactic acid bacteria on LDL in male rats with carbimazole-induced hypothyroidism (mean ± standard error).**

| Treatments | Low-density lipoprotein concentration (mg.dl\(^{-1}\)) |
|------------|------------------------------------------------------|
| T1         | 35.40\(^a\) ± 0.389                                  |
| T2         | 63.10\(^b\) ± 0.645                                  |
| T3         | 56.06\(^c\) ± 0.858                                  |
| T4         | 38.07\(^d\) ± 0.638                                  |
| T5         | 37.82\(^e\) ± 0.564                                  |
| T6         | 50.00\(^f\) ± 0.811                                  |
| T7         | 36.18\(^g\) ± 0.477                                  |
| T8         | 50.98\(^h\) ± 0.425                                  |
| T9         | 40.00\(^i\) ± 0.778                                  |

Means in the same vertically with different letters show significant differences (P<0.05).

**Very Low-Density Lipoprotein**

The results of the table (6) revealed a significant increase (P <0.05) in the amount of very-low-density protein in the serum of rats with hypothyroidism, reaching a level of 18.9 mg.kg\(^{-1}\) compared to control group rats with an average of 12.4 mg.kg\(^{-1}\), and the reason may be attributed to that. It is also noted from the results of the table that the dosing of rats with the milk product containing lactic acid bacteria and its mixture led to a significant decrease in the amount of VLDL in the blood serum of the rats to reach the lowest average when the doses of the rats with the milk product containing the bacteria *L. plantarium* and acetic *L. plantarium* were most effective and at a significant level (P <0.05) in reducing the level of VLDL in the rat blood serum where the average was 14.94 and 14.23 mg.kg\(^{-1}\), respectively.

**Table (6): Effect of lactic product enhanced with lactic acid bacteria on VLDL in male rats with carbimazole-induced hypothyroidism. (mean ± standard error).**

| Treatments | Very low-density lipoprotein concentration (mg.dl\(^{-1}\)) |
|------------|---------------------------------------------------------|
| T1         | 12.40\(^a\) ± 0.593                                   |
| T2         | 18.90\(^b\) ± 0.518                                   |
| T3         | 17.03\(^c\) ± 0.422                                   |
| T4         | 13.00\(^d\) ± 0.547                                   |
| T5         | 12.95\(^e\) ± 0.219                                   |
| T6         | 14.94\(^f\) ± 0.511                                   |
| T7         | 13.11\(^g\) ± 0.222                                   |
| T8         | 14.23\(^h\) ± 0.548                                   |
| T9         | 14.00\(^i\) ± 0.056                                   |
Means in the same vertically with different letters show significant differences (P<0.05).

and *L. casei*, the effect was significant (P<0.05), with an average of 13 mg.kg⁻¹ each. This may be attributed to the role of lactic acid bacteria in metabolism (Abdullah *et al.*, 2013; Ma *et al.*, 2019).

**Conclusions**

Lactic acid bacteria have an inhibitory efficacy of the negative effects of carbimazole and the occurrence of hypothyroidism and the possibility of its safe use in regulating the work of the thyroid gland and significant decrease in the levels of total cholesterol, triglycerides, LDL, and VLDL with a significant increase in the level of HDL in the blood serum of rats with hypothyroidism induced by carbimazole when dosing with fortified milk in lactic acid bacteria compared to the control sample. These results are encouraging to use this product by people with heart disease and arterial hypertension.

**Acknowledgements**

We offer sincere thanks and appreciation to the Deanship of College of Agriculture and to the head and to all members of the Department of Food Science, and my thanks to Ali A. Khalaf from the Department of Animal Production to help with lab work.

**Conflict of interest:** The authors declare that they have no conflict of interest.

**ORCID:**

E.K. Nasser [https://orcid.org/0000-0003-1917-9672](https://orcid.org/0000-0003-1917-9672)

K. R. Majeed [https://orcid.org/0000-0002-7109-9621](https://orcid.org/0000-0002-7109-9621)

H. I. Ali [https://orcid.org/0000-0001-5185-6093](https://orcid.org/0000-0001-5185-6093)

**References**

Abbas, J. M., Chakraborty, J., Akanji, A. O., & Doi, S. A. (2008). Hypothyroidism results in small dense LDL independent of IRS traits and hypertriglyceridemia. *Endocrine Journal*, 55, 381-389. [https://www.jstage.jst.go.jp/article/endocrj/55/2/55-K07E-065/_pdf](https://www.jstage.jst.go.jp/article/endocrj/55/2/55-K07E-065/_pdf)

Abdullah, Kh. Sh., Salih, H. M. & Mohammed, N. F. (2013). The impact of the yoghurt product by using the lactic acid bacteria (ABT) in reducing the level of lioid profil in blood of rats and increase weights. *Tikrit University Journal of Agricultural Sciences*, 13, 14-22. [https://www.iasj.net/iasj/download/8c9fd82dfb389dda](https://www.iasj.net/iasj/download/8c9fd82dfb389dda)

Bartley, G. E., Yokoyama, W., Young, S. A., Anderson, W. H., Hung, S. C., Albers, D. R., & Kim, H. (2010). Hypocholesterolemic effects of hydroxypropyl methylcellulose are mediated by altered gene expression in hepatic bile and cholesterol pathways of male hamsters. *Journal of Nutrition*, 140, 1255-1260. [https://doi.org/10.3945/jn.109.118349](https://doi.org/10.3945/jn.109.118349)

Burtis, C. A., Ashwood, E. R., & Bruns, D. E. (2012). Tietz textbook of clinical chemistry and molecular diagnostics-e-book. Elsevier Health Sciences. [https://pdfs.semanticscholar.org/3834/df782292516300748abdb6b0ca39af0d2a9.pdf](https://pdfs.semanticscholar.org/3834/df782292516300748abdb6b0ca39af0d2a9.pdf)

Ding, W., Shi, C., Chen, M., Zhou, J., Long, R., & Guo, X. (2017). Screening for lactic acid bacteria in traditional fermented Tibetan yak milk and evaluating their probiotic and cholesterol-lowering potentials in rats fed a high-cholesterol diet. *Journal of Functional Foods*, 32, 324-332. [https://doi.org/10.1016/j.jff.2017.03.021](https://doi.org/10.1016/j.jff.2017.03.021)

El-Shafie, H. A., Yahia, N. I., Ali, H. A., Khalil, F. A., El-Kady, E. M., & Moustafa, Y. A. (2009). Hypocholesterolemic action of Lactobacillus plantarum NRRL-B-4524 and Lactobacillus paracasei in rats with hypercholesterolemia induced by diet. *Australian Journal of Basic and Applied Sciences*, 3, 218-228. [https://www.researchgate.net/profile/Ebtsam_ElKady/publication/344291389_Hypocholesterolemic_Action_of_Lactobacillus_plantarum_NRRL-B-4524_and_Lactobacillus_paracasei_in_Mice_with](https://www.researchgate.net/profile/Ebtsam_ElKady/publication/344291389_Hypocholesterolemic_Action_of_Lactobacillus_plantarum_NRRL-B-4524_and_Lactobacillus_paracasei_in_Mice_with)
Hypercholesterolemia_Induced_by_Diet/links/55dd 86ab08ade83e420e0e75af/Hypercholesterolemic- Action-of-Lactobacillus-plantarum-NRRL-B-4524- and-Lactobacillus-paracasei-in-Mice-with- Hypercholesterolemia-Induced-by-Diet.pdf.

Gaudana, S. B., Dhanani, A. S., & Bagchi, T. (2010). Probiotic attributes of Lactobacillus strains isolated from food and of human origin. British Journal of Nutrition, 103, 1620-1628. DOI: 10.1017/S0007114509993643. Epub 2010 Jan 14.

Kalender, S., Uzun, F. G., Durak, D., Demir, F., & Kalender, Y. (2010). Malathion-induced hepatotoxicity in rats: the effects of vitamins C and E. Food and Chemical Toxicology, 48, 633-638. https://doi.org/10.1016/j.fct.2009.11.044

Kumar, M., Nagpal, R., Kumar, R., Hemalatha, R., Verma, V., Kumar, A., Chakraborty, C., Singh, B., Marotta, F., Jain, S., & Yadav, H. (2012). Cholesterol-lowering probiotics as potential biotherapeutics for metabolic diseases. Experimental Diabetes Research, 2012, 902917, 14pp. https://doi.org/10.1155/2012/902917

Ma, C., Zhang, S., Lu, J., Zhang, C., Pang, X., & Lv, J. (2019). Screening for cholesterol-lowering probiotics from lactic acid bacteria isolated from corn silage based on three hypothesized pathways. International Journal of Molecular Sciences, 20, 2073. https://doi.org/10.3390/ijms20092073

Nichols, M., Townsend, N., Scarborough, P., & Rayner, M. (2013). Cardiovascular disease in Europe: epidemiological update. European Heart Journal, 34, 3028-3034. https://doi.org/10.1093/eurheartj/eh356

Pavlí, F., Tassou, C., Nychas, G. J. E., & Chorianopoulos, N. (2018). Probiotic incorporation in edible films and coatings: Bioactive solution for functional foods. International Journal of Molecular Sciences, 19, 150. DOI: 10.3390/ijms19010150

Reeves, P. G. (1996). AIN-93 purified diets for the study of trace element metabolism in rodents (Vol. 1, pp. 3-37). Boca Raton, FL: CRC Press. https://books.google.iq/books?hl=ar&lr&id=21ChNSAeVekC&oi=fnd&pg=PA3&dq=AIN%2093%20(1995) +method&ots=4v62n-P TMP&sig=06IQDHiKnKTwjdYcOGQkRngEFa4&r edir_esc=y&pli=1#v=onepage&q=AIN%2093%20(1995)%20method&f=false

SAS (1990). SAS User’s Guide, Statistics, Cary, NC, SAS Institute.

Saxena, S., Funk, M., & Chisholm, D. (2013). World health assembly adopts a comprehensive mental health action plan 2013–2020. The Lancet, 381, 1970-1971. https://www.thelancet.com/journals/lancet/article/PIIS01932766(13)61139-8/fulltext

Wang, C. Y., Wu, S. C., Ng, C. C., & Shyu, Y. T. (2010). Effect of Lactobacillus-fermented adlay-based milk on lipid metabolism of hamsters fed a cholesterol-enriched diet. Food Research International, 43, 819-824. https://doi.org/10.1016/j.foodres.2009.11.020

To affect some strains of bacteria, carbimazole only reduces levels of cholesterol in the arteries of animals (Rattus norvegicus)

L. acidophilus and L. casei and L. plantarum, the bacteria, and carbimazole: The use of the hormone to regulate cholesterol levels in the arteries of animals (Rattus norvegicus)

Pavli, F., Tassou, C., Nychas, G. J. E., & Chorianopoulos, N. (2018). Probiotic incorporation in edible films and coatings: Bioactive solution for functional foods. International Journal of Molecular Sciences, 19, 150. DOI: 10.3390/ijms19010150

Reeves, P. G. (1996). AIN-93 purified diets for the study of trace element metabolism in rodents (Vol. 1, pp. 3-37). Boca Raton, FL: CRC Press. https://books.google.iq/books?hl=ar&lr&id=21ChNSAeVekC&oi=fnd&pg=PA3&dq=AIN%2093%20(1995) +method&ots=4v62n-P TMP&sig=06IQDHiKnKTwjdYcOGQkRngEFa4&r edir_esc=y&pli=1#v=onepage&q=AIN%2093%20(1995)%20method&f=false

SAS (1990). SAS User’s Guide, Statistics, Cary, NC, SAS Institute.

Saxena, S., Funk, M., & Chisholm, D. (2013). World health assembly adopts a comprehensive mental health action plan 2013–2020. The Lancet, 381, 1970-1971. https://www.thelancet.com/journals/lancet/article/PIIS01932766(13)61139-8/fulltext

Wang, C. Y., Wu, S. C., Ng, C. C., & Shyu, Y. T. (2010). Effect of Lactobacillus-fermented adlay-based milk on lipid metabolism of hamsters fed a cholesterol-enriched diet. Food Research International, 43, 819-824. https://doi.org/10.1016/j.foodres.2009.11.020

To affect some strains of bacteria, carbimazole only reduces levels of cholesterol in the arteries of animals (Rattus norvegicus)

L. acidophilus and L. casei and L. plantarum, the bacteria, and carbimazole: The use of the hormone to regulate cholesterol levels in the arteries of animals (Rattus norvegicus)