

# Long-Team Ketogenic Diet Alters Kidney Function through Increasing Serum Creatinine Levels in Mice

*by Alif Lutvyani*

---

**Submission date:** 16-Jun-2021 12:21PM (UTC+0800)

**Submission ID:** 1607298475

**File name:** Function\_through\_Increasing\_Serum\_Creatinine\_Levels\_in\_Mice.pdf (577.04K)

**Word count:** 6950

**Character count:** 30795

Open Access Article

## Long-Term Ketogenic Diet Alters Kidney Function through Increasing Serum Creatinine Levels in Mice

Alif Lutvyani<sup>1</sup>, Artaria Tjempakasari<sup>2</sup>, Purwo Sri Rejeki<sup>3,\*</sup>

<sup>1</sup> Medicine Program, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

<sup>2</sup> Department of Internal Medicine, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

<sup>3</sup> Department of Physiology, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

**Abstract:** In recent years, the ketogenic diet has become a choice for overweight or obese people to lose weight and healthy people to maintain health. However, the adverse events of a long-term ketogenic diet in the kidney are not very clear. This study aimed to determine the ketogenic diet's long-term effect on serum creatinine as a renal function biomarker. Eighteen male mice (20-30 g) aged 2-3 months were divided into two groups: K1 (standard diet; n=9) and K2 (ketogenic diet; n=9) were given a diet for 8 weeks *ad libitum*. Body weight was measured in pre and post-intervention, serum creatinine levels were measured post-intervention. Serum creatinine levels were measured using a colorimetric assay. Data were analyzed for normality test, independent t-test, and Mann-Whitney using SPSS.  $\Delta$ Body weight on K1 (17.000±7.089) g, K2 (5.222±4.549) g with  $p=0.002$ . Serum creatinine levels on K1 (19.958±4.458)  $\mu\text{g/mL}$ , K2 (27.835±7.918)  $\mu\text{g/mL}$  with  $p=0.019$ . In conclusion, a long-term ketogenic diet increases serum creatinine levels and induced slower body weight gain.

**Keywords:** ketogenic diet, kidney, mice, serum creatinine.

## 长期生酮饮食通过增加小鼠血清肌酐水平来改变肾脏功能

**摘要:** 近年来, 生酮饮食已成为超重或肥胖的人减肥和健康人保持健康的一种选择。但是, 肾脏中长期生酮饮食的不良事件还不是很清楚。这项研究旨在确定生酮饮食对血清肌酐作为肾脏功能生物标志物的长期影响。将 2-3 个月大的 18 只雄性小鼠 (20-30g) 分成两组: 随意给予 K1 (标准饮食; n = 9) 和 K2 (生酮饮食; n = 9), 饮食为 8 周。在干预之前和之后测量体重, 在干预之后测量血清肌酐水平。使用比色测定法测量血清肌酐水平。使用 SPSS 对数据进行正态性检验, 独立 t 检验和曼-惠特尼分析。body 体重在 K1 (17.000±7.089) g, K2 (5.222±4.549) g 上,  $p = 0.002$ 。K1 (19.958±4.458) 微克/毫升, K2 (27.835±7.918) 微克/毫升的血清肌酐水平,  $p = 0.019$ 。总之, 长期生酮饮食会增加血清肌酐水平, 并导致体重增加减慢。

**关键词:** 生酮饮食, 肾脏, 小鼠, 血清肌酐。

### 1. Introduction

Obesity is a complex disease and becomes a global epidemic, with the prevalence rate still increasing. In 2016 obesity affects 650 million people globally. There was a triple increase compared to 1975 [1]. The obesity prevalence in Indonesia increased significantly, 10.5% in 2007, 14.8% in 2013, and 21.8% in 2018 [2].

Meanwhile, obesity correlates with some diseases such as diabetes [3], cancer [4], hypertension [5], and cardiovascular disease [6]. Obesity is a multifactorial disease with multifactorial causes such as genetics, lifestyle, and environment [7]. Obesity is determined by a Body Mass Index (BMI) of more than 30  $\text{kg/m}^2$  [1]. Weight loss is the main goal in many therapies of

Received: 9 January 2021 / Revised: 20 January 2021 / Accepted: 13 February 2021 / Published: 28 February 2021

About the authors: Alif Lutvyani, Medicine Program, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia; Artaria Tjempakasari, Department of Internal Medicine, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia; Purwo Sri Rejeki, Department of Physiology, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

Corresponding author Purwo Sri Rejeki, [purwo-s-r@fk.unair.ac.id](mailto:purwo-s-r@fk.unair.ac.id), [purwo\\_faal@yahoo.com](mailto:purwo_faal@yahoo.com)

obesity. Factors correlate with weight loss are diet, physical activity, environmental, behavioral, physiological factor, and regulation from hormone and peptide [6]. The ketogenic diet (KD) is one of the non-pharmacological treatments for obesity. The ketogenic diet was first used to treat epilepsy [8] and neurodegenerative diseases [9]. Since 1800, the ketogenic diet trend for weight loss to treat obesity has kept increasing [10]. The ketogenic diet is a low-carbohydrate diet (<50 g/day), high ratio of fat, and moderate to relatively increase protein [11]. A high-fat diet is not safe for kidneys in some studies and can induce kidney dysfunction [12, 13]. Nevertheless, the effect of a long-term ketogenic diet on serum creatinine as a biomarker of kidney function was not explained clearly.

Intake of a high-fat diet and low in carbohydrates can stimulate glucagon and reduce insulin activities. Therefore the ketogenesis process occurs, begins with lipolysis of fat, then the breakdown of glycogen in the liver. This process produces ketone bodies as an energy source. This ketogenesis process increases the levels of ketone bodies in the blood and urine. This condition is called ketosis [14]. Ketosis is believed to have anti-inflammatory effects by suppressing the NLRP3 inflammatory. Pro-inflammatory cytokines include IL-1 $\beta$  and IL-18 from macrophages, production of inflammatory cytokines such as TNF- $\alpha$ , IL-1, IL-6, IL-18, and prostaglandin E2 [15]. A ketogenic diet with the composition of 60% fat, 30% protein, and 10% fiber was proven to have an optimal effect for weight loss and decreasing visceral fat mass [16]. However, a long-term ketogenic diet can induce lipid accumulation in the kidneys, triggering an inflammatory process characterized by increasing pro-inflammatory cytokines IL-1, IL-6, and TNF- $\alpha$  [17]. This inflammatory process can cause glomerular retraction [18]. Thus, kidney function for excretion of metabolic waste through urine and central homeostasis in the body will be disturbed [19]. Disturbances in kidney function can be measured using several biomarkers such as serum creatinine, serum urea, cystatin c, urine albumin, and others [20]. Serum creatinine is a commonly used biomarker because it can detect abnormalities in the glomerulus and kidney tubules. It is easy to obtain, cheap, and known for a long time as the gold standard for examining kidney function [21]. Increasing serum creatinine levels is a sign of impaired kidney function [22]. The previous study showed a different result. Ketogenic diet in rats with the composition of 86.19% fat for 60 days did not significantly increase serum creatinine levels [23]. Nevertheless, another study showed a significant increase in serum creatinine levels in mice with the composition of 43% fat for 32 weeks [24]. According to several studies mentioned above, the ketogenic diet's expected benefits still contradict the side effects. The effect of a long-term ketogenic diet on serum creatinine

levels is not known clearly. Hence, it is necessary to research to determine the ketogenic diet's long-term effects on the kidneys using serum creatinine. This study aimed to determine the ketogenic diet's long-term effect for 8 weeks on serum creatinine levels.

34

## 2. Materials and Methods

### 2.1. Experimental Design

This study was a laboratory experiment with a pretest-posttest control group design. The study subjects were 18 male mice (*Mus musculus*), aged 2-3 months, 20-30 gram. The eighteen mice were acclimated using a standard diet and water *ad libitum* in the laboratory for 7 days before starting treatment. The mice were assigned randomly into 2 groups. The control group (K1) was given a standard diet (n=9), and the treatment group (K2) was given a ketogenic diet with a composition of 60% fat, 30% protein, and 10% fiber (n = 9) for 8 weeks and water *ad libitum*. The study was conducted at the Laboratory Animals of Biochemistry, Faculty of Medicine, Universitas Airlangga, for 9 weeks. Animals were maintained under the same condition, with room temperature 37°C $\pm$ 0.5°C, 12-h light/12-h dark cycle. The cage was 30x45x20 cm, made of plastic covered with wire mesh, equipped with a drinking bottle. Each cage is filled with 1 group of 9 mice. Standard and ketogenic diets were given at 11.00 a.m-12.00 p.m. All procedures in this experiment were performed in accordance with animal welfare principles in experimental science published in the European Convention for the Protection of Vertebrate Animal and approved by the Research Ethics Committee of Health Faculty, Faculty of Medicine, Universitas Airlangga (No. 236/EC/KEPK/FKUA/2020).

### 2.2. Body Weight Measurement

Bodyweight was measured on pre-treatment (before the diet was given) and post-treatment (24-hours after the last diet). Bodyweight was measured using Harnic HL-3650 Heles Digital Scale (scale 0-5 kg).

### 2.3. Blood Samples

Blood samples were collected through cardiac puncture 24-hours after the last diet, then centrifuged for 5 minutes with the rate of 4,000 rpm to collect the serum.

### 2.4. Serum Creatinine Levels Assessment

Serum creatinine levels were determined using a calorimetric assay (StressXpress Creatinine Serum Detection Kit, StressMarq Biosciences, Victoria BC, Canada) according to the instruction on the reagent kit. Kit sensitivity is 0.081 mg/dL and the assay range is 0.5 - 4 mg/dL.

### 2.5. Statistical Analysis

The obtained data were analyzed using Statistic Package for Social Science (SPSS) IBM 16 software. Data distribution was examined to determine the data distributed normally or not by the Shapiro Wilk test. The data with normal distribution were analyzed with an Independent t-test, while the Mann-Whitney test analyzed the data with no normal distribution. The

result with  $p < 0.05$  shows a significant difference. All data were presented by mean  $\pm$  SD.

### 3. Result

Results of pre-treatment, post-treatment body weight are shown in Table 1.

Table 1 Characteristics of the subjects

Variable	K1 (n=9)	K2 (n=9)	Independent T-Test P-Value
Pre-treatment body weight (g)	25.333 $\pm$ 2.398	27.111 $\pm$ 2.088	0.113
Post-treatment body weight (g)	41.556 $\pm$ 7.699	32.333 $\pm$ 5.123	0.009

Note: Data are presented as mean  $\pm$  SD. K1: Standard Diet; K2: Ketogenic Diet.

This study results in no significant difference in K1 and K2 pre-treatment body weight ( $p > 0.05$ ). Bodyweight on K1 and K2 post-treatment showed significantly different ( $p < 0.05$ ). The ketogenic diet group has a lower weight at the end of this study. Statistical analysis result of delta ( $\Delta$ ) body weight is displayed in Fig. 1. The difference of body weight ( $\Delta$ ) also significantly different on K2 compared with K1 (17.000 $\pm$ 7.089 vs. 5.222 $\pm$ 4.549 g, ( $p$ -value=0.002)).  $\Delta$  Bodyweight on the ketogenic diet is lower than the standard diet. The analytical result of post-intervention serum creatinine levels is shown in Fig. 2. After 8 weeks on a diet, serum creatinine levels were significantly increased on the ketogenic diet compared to the standard diet (19.958 $\pm$ 4.458 vs. 27.835 $\pm$ 7.918  $\mu$ g/mL, ( $p$ -value=0.019)).

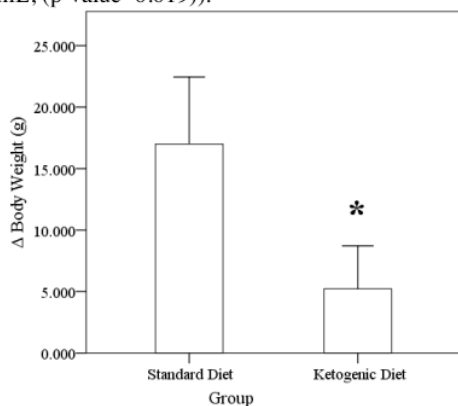


Fig. 1 Delta ( $\Delta$ ) body weight (g)

\* There was a significant difference ( $p < 0.05$ ) in the Mann-Whitney test

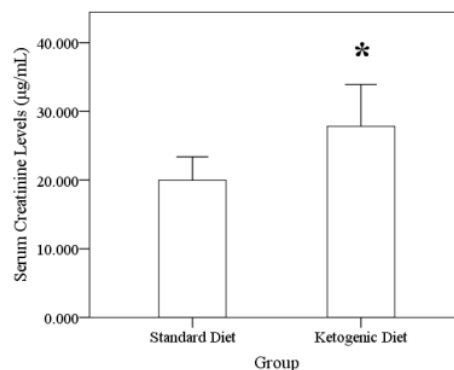


Fig. 2 Serum creatinine levels

\* There was a significant difference ( $p < 0.05$ ) in independent T-test

### 4. Discussion

In this study, 8 weeks ketogenic diet in mice showed slowed weight gain and elevated serum creatinine levels compared with the standard diet. The mean serum creatinine levels post-intervention in the ketogenic diet showed a significant difference ( $p = 0.019$ ). Serum creatinine levels in the ketogenic diet were significantly increased compared with the standard diet. These results are consistent with the ketogenic diet in 30 days in rats with the composition of 65% fat [22] and the ketogenic diet in mice with the composition of 43% fat for 32 weeks [25].

This diet causes a condition that mimics fasting. The body will use stored fat as an energy source through the fat oxidation process, which produces ketone bodies. High levels of circulating ketone bodies result in a condition called ketosis [26]. Ketosis induced decrease insulin levels and increase glucagon levels, resulting in lipolysis, glycogenolysis, and gluconeogenesis [24]. This causes increase fat in the circulation, accumulation of fat in the visceral organs and bone marrow [17]. Accumulation of fat in the kidneys can occur in mesangial cells, podocytes, proximal tubules, and tubulointerstitial tissue, which will affect the structure and function of the nephrons [27].

Accumulation of fat in the kidneys can increase pro-inflammatory cytokines such as interleukin-1 (IL-1),

interleukin-6 (IL-6), and TNF- $\alpha$  [17]. Inflammation in the kidney and systemic will induce the secretion of hormones and vasoactive molecules such as prostaglandins, endothelin, kinins, medulipine, nitric oxide, and other molecules. Slight changes in the intermolecular balance can interfere with kidney function because kidneys have a microvascular system to balance the osmotic gradient in fluid absorption and urine concentration. Increased production of reactive oxygen/nitrogen species, bioactive compounds in lipids, and intermolecular adhesion in the inflammatory process will lead to the progression of Chronic Kidney Disease (CKD) [24].

Fat accumulation can stimulate a vasoactive hormone (angiotensin II), which caused glomerular retraction due to glomerular mesangial cells' contraction [18]. Furthermore, this regulatory disorder can cause damage to podocyte cells, proximal tubules, and tubulointerstitial tissue [14]. This causes proteinuria, loss of podocyte cells, insulin resistance, oxidative stress, fibrosis, apoptosis, and hypertrophy, leading to chronic kidney disease (CKD) [28]. Kidney function as an excretory organ can be impaired and cause decreasing in GFR value. A decrease in GFR can be identified through one of the biomarkers, namely serum creatinine. An increase in serum creatinine levels indicates decreased GFR, which can be caused by decreased kidney function [29].

PAS (periodic acid Schiff) staining carried out in the high-fat diet group at 32 weeks showed glomerulosclerosis score index was higher than the standard feed group, presence of tubulointerstitial fibrosis include interstitial dilation, accumulation of inflammatory cells, tubular atrophy, and tubular basement membrane, which shrink and/or thicken, cast on the tubule. The most visible thing is the presence of tubular vacuolation and tubular dilation [25]. In physiological conditions, the kidneys have the ability to heal on their own after minor structural abnormalities, but if there is continuous damage or severe damage can form fibrosis. This tubulointerstitial fibrosis can cause kidney function to decrease progressively [30]. There are two types of glomerulosclerosis, crescent and global glomerulosclerosis, high glomerulosclerosis score indicating the extent of glomerulosclerosis. Crescent glomerulosclerosis in more than 25% of the glomerulus causes progressive progression of the disease and requires early pharmacological therapy. Global glomerulosclerosis is an indicator of a rapidly progressing irreversible structural disorder, failure of therapy, and a worse renal function decline [31]. Elevation of serum creatinine levels and decrease of eGFR were seen in patients with focal segmental glomerulosclerosis (FSGS), which indicates a deterioration in the patient's prognosis. The prognosis of patients who develop end-stage kidney disease (ESKD) is confirmed if the elevated serum creatinine is accompanied by tubulointerstitial fibrosis [32].

Bodyweight before intervention shows no significant difference ( $p=0.113$ ), it means the characteristic of all subjects in two groups was same before the intervention. In this experiment, body weight post-intervention was significantly different ( $p=0.009$ ), and the ketogenic diet group showed lower body weight than the standard diet group. Delta (post – pre-intervention) body weight showed a significant difference ( $p=0.002$ ), and lower weight gain was presented in the ketogenic diet. These results are consistent with the previous report concluding that a ketogenic diet with 90% lipid and 10% protein induced slower weight gain [33]. In another study, ketogenic and standard diet showed increased body weight after 4 weeks of the intervention [34]. The difference between the two groups is that the ketogenic diet increased body fat mass and decreased lean body mass. In contrast, the control group reported no change in the proportion between fat mass and lean body mass. This condition began in the second week. Moreover, significant weight loss is accompanied by reducing of visceral fat [16].

The mechanism of the slowdown weight gain in the ketogenic diet is not completely clear. One of the mechanisms that occur is changes in resting energy expenditure [14]. A decrease in carbohydrates' composition, accompanied by a fixed amount of protein and total calories, can induce energy expenditure changes. In the carbohydrate-insulin hypothesis, it is explained that a decrease in the ratio of carbohydrates to fat accompanied by a fixed amount of protein and total energy can reduce insulin levels in the circulation, therefore triggers lipolysis and oxidation of the stored fat cause an increase in energy demand. Otherwise, in the energy balance hypothesis, the fat consumed has the same calories as carbohydrates. The result showed no change in energy requirements [35].

Ketogenic diet with or without aerobic exercise for 6 weeks in mice with diabetes showed a lower body weight than diabetic mice without treated by ketogenic diet with or without aerobic exercise. Mice that received a ketogenic diet with or without aerobic exercise experienced decreased food and drink intake, resulting in weight loss [36]. Elevated ketone levels, ketosis, can trigger central and peripheral stimuli that can induce anorexigenic effects [37]. Ketone bodies have the ability to reduce appetite, especially in  $\beta$ -hydroxybutyrate, which is a signal of energy and satiety (central satiety signal) [38]. Significant weight loss can occur if orexigenic triggers were inhibited, such as inhibiting ghrelin and increasing leptin levels, so that appetite decreases [37].

A significant increase of serum creatinine levels in a long-term ketogenic diet is important cautions. Based on this study, a ketogenic diet for 56 days in mice showed increasing serum creatinine levels. If converted to human age, it will take about 6 years [39]. Therefore, the ketogenic diet for a duration of 6 years

in humans can harm the kidneys. Reduce renal function for creatinine excretion may induce renal injury or kidney disease such as kidney stone [40]. Patients who suffer from kidney disease should avoid using this diet to prevent chronic kidney disease development [28]. Weight loss in a ketogenic diet is a benefit to treat overweight or obesity. It also can be an option to treat DMT2 because it can resolve hyperglycemia, lowered fasting insulin levels, decreased insulin resistance, and minimum intake of oral glycemic or insulin medication [40].

## 5. Conclusion

This study showed that a long-term ketogenic diet in 8 weeks increases serum creatinine levels and slows down weight gain. Slowed weight gain resulting from a ketogenic diet can be used as a non-pharmacological treatment for obesity and diabetes patients. Nevertheless, the ketogenic diet's long-term effect should be an important caution, especially the kidney's adverse event, such as kidney stone. Patients who suffer from kidney disease should avoid using this diet to prevent chronic kidney disease development. Therefore, further studies and explanations are needed to analyze the kidney histopathology after ketogenic diet to certain the morphological damage and combining with other biomarkers such as cystatin c and urine albumin to creatinine ratio for better confirmation. Additional research is needed to determine the safe duration of the ketogenic diet, which has optimal benefits with a minimum side effect.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Acknowledgment

This research was under the funding of the Directorate of Research and Community Service, Deputy for Strengthening Research and Development, Ministry of Research and Technology/National Research and Innovation Agency.

## References

- [1] WORLD HEALTH ORGANIZATION. *Obesity and overweight*, 2020. <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>
- [2] RISKESDAS. *Laporan Nasional Riset Kesehatan Dasar*. Jakarta, 2018. <http://www.kesmas.kemkes.go.id>
- [3] CHOBOT A., GÓROWSKA-KOWOLIK K., SOKOŁOWSKA M., and JAROSZ-CHOBOT P. Obesity and diabetes—Not only a simple link between two epidemics. *Diabetes/Metabolism Research and Reviews*, 2018, 34(7): 1–9. <https://dx.doi.org/10.1002/dmrr.3042>
- [4] STONE T. W., MCPHERSON M., and GAIL DARLINGTON L. Obesity and Cancer: Existing and New

- Hypotheses for a Causal Connection. *EBioMedicine*, 2018, 30: 14–28. <https://dx.doi.org/10.1016/j.ebiom.2018.02.022>
- [5] LIN Y.-A., CHEN Y.-J., TSAO Y.-C., YEH W.-C., LI W.-C., TZENG I.-S., and CHEN J.-Y. Relationship between obesity indices and hypertension among middle-aged and elderly populations in Taiwan: A community-based, cross-sectional study. *BMJ Open*, 2019, 9(10): 1–8. <http://dx.doi.org/10.1136/bmjopen-2019-031660>
  - [6] CERCATO C., & FONSECA F. A. Cardiovascular risk and obesity. *Diabetology & Metabolic Syndrome*, 2019, 11(1): 1–15. <https://dx.doi.org/10.1186/s13098-019-0468-0>
  - [7] ALBUQUERQUE D., NÓBREGA C., MANCO L., and PADEZ C. The contribution of genetics and environment to obesity. *British Medical Bulletin*, 2017, 123(1): 159–173. <http://dx.doi.org/10.1093/bmb/ldx022>
  - [8] GOSWAMI J. N., & SHARMA S. Current perspectives on the role of the Ketogenic diet in epilepsy management. *Neuropsychiatric Disease and Treatment*, 2019, 15: 3273–3285. <http://dx.doi.org/10.2147/NDT.S201862>
  - [9] WŁODAREK D. Role of ketogenic diets in neurodegenerative diseases (Alzheimer's disease and parkinson's disease). *Nutrients*, 2019, 11(169): 1–11. <https://dx.doi.org/10.3390/nu11010169>
  - [10] IACOVIDES S., & MEIRING R. M. The effect of a ketogenic diet versus a high-carbohydrate, low-fat diet on sleep, cognition, thyroid function, and cardiovascular health independent of weight loss: Study protocol for a randomized controlled trial. *Trials*, 2018, 19(1): 1–9. <https://dx.doi.org/10.1186/s13063-018-2462-5>
  - [11] SHILPA J., & MOHAN V. Ketogenic diets: Boon or bane? *Indian Journal of Medical Research*, 2018, 148(3): 251–253. [https://dx.doi.org/10.4103/ijmr.IJMR\\_1666\\_18](https://dx.doi.org/10.4103/ijmr.IJMR_1666_18)
  - [12] SILVARES R. R., DA SILVA PEREIRA E. N. G., FLORES E. E. I., RODRIGUES K. L., SILVA A. R., GONÇALVES-DE-ALBUQUERQUE C. F., and DALIRY A. High-fat diet-induced kidney alterations in rats with metabolic syndrome: Endothelial dysfunction and decreased antioxidant defense. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, 2019, 12: 1773–1781. <https://dx.doi.org/10.2147/DMSO.S211253>
  - [13] SUN Y., GE X., LI X., HE J., WEI X., DU J., SUN J., LI X., XUN Z., LIU W., ZHANG H., WANG Z.-Y., and LI Y. C. High-fat diet promotes renal injury by inducing oxidative stress and mitochondrial dysfunction. *Cell Death and Disease*, 2020, 11(10): 1–14. <http://dx.doi.org/10.1038/s41419-020-03122-4>
  - [14] GERSHUNI V. M., YAN S. L., and MEDICI V. Nutritional Ketosis for Weight Management and Reversal of Metabolic Syndrome. *Current Nutrition Report*, 2018, 7(3): 97–106. <https://dx.doi.org/10.1007/s13668-018-0235-0>
  - [15] WEBER D. D., AMINZADEH-GOHARI S., TULIPAN J., CATALANO L., FEICHTINGER R. G., and KOFLER B. Ketogenic diet in the treatment of cancer – Where do we stand? *Molecular Metabolism*, 2020, 33: 102–121. <https://dx.doi.org/10.1016/j.molmet.2019.06.026>
  - [16] SYAHRAYA I., NOVIDA H., HERAWATI L., and REJEKI P. S. Effect of High Fat Diet on Weight Loss Through the Expression of Uncouple Protein 1 in Mice Visceral Fat. *Folia Medica Indonesiana*, 2020, 56(3): 223–228. <http://dx.doi.org/10.20473/fmi.v56i3.24576>
  - [17] GUPTA L., KHANDELWAL D., KALRA S., GUPTA P., DUTTA D., and AGGARWAL S. Ketogenic diet in endocrine disorders: Current perspectives. *Journal of*

- Postgraduate Medicine*, 2017, 63(4): 242–251. [https://dx.doi.org/10.4103/jpgm.JPGM\\_16\\_17](https://dx.doi.org/10.4103/jpgm.JPGM_16_17)
- [18] MULLER C. R., LEITE A. P. O., YOKOTA R., PEREIRA R. O., AMERICO A. L. V., NASCIMENTO N. R. F., EVANGELISTA F. S., FARAH V., FONTELES M. C., and FIORINO P. Post-weaning exposure to high-fat diet induces kidney lipid accumulation and function impairment in adult rats. *Frontiers in Nutrition*, 2019, 6(60): 1–8. <https://dx.doi.org/10.3389/fnut.2019.00060>
- [19] RAYNER H., MILFORD D., and THOMAS M. Kidney Anatomy and Physiology. In: RAYNER H. C., THOMAS M., and MILFORD D. *Understanding Kidney Diseases*. Springer International Publishing, Cham, 2016: 1–10. [https://doi.org/10.1007/978-3-319-23458-8\\_1](https://doi.org/10.1007/978-3-319-23458-8_1)
- [20] KRSTIC D., TOMIC N., RADOSAVLJEVIC B., AVRAMOVIC N., DRAGUTINOVIC V., SKODRIC S. R., and COLOVIC M. Biochemical Markers of Renal Function. *Current Medicinal Chemistry*, 2016, 23(19): 2018–2040. <https://doi.org/10.2174/0929867323666160115130241>
- [21] ZHANG W. R., & PARIKH C. R. Biomarkers of Acute and Chronic Kidney Disease. *Annual Review of Physiology*, 2019, 81: 309–333. <https://dx.doi.org/10.1146/annurev-physiol-020518-114605>
- [22] EIYA B., & OSAKUE J. Effect of high fat ketogenic diet on some cardiovascular and renal parameters in Wistar albino rats Effect of high fat ketogenic diet on some cardiovascular and renal parameters in Wistar albino rats. *International Journal of Biological and Chemical Science*, 2019, 12(6): 2703–2712. <https://dx.doi.org/10.4314/ijbcs.v12i6.19>
- [23] ARSYAD A., IDRIS I., RASYID A. A., USMAN R. A., FARADILLAH K. R., LATIF W. O. U., LUBIS Z. I., AMINUDDIN A., YUSTISIA I., and DJABIR Y. Y. Long-Term Ketogenic Diet Induces Metabolic Acidosis, Anemia, and Oxidative Stress in Healthy Wistar Rats. *Journal of Nutrition and Metabolism*, 2020, 2020: 1–7. <https://dx.doi.org/10.1155/2020/3642035>
- [24] MIHAI S., CODRICI E., POPESCU I. D., ENCIU A.-M., ALBULESCU L., NECULA L. G., MAMBET C., ANTON G., and TANASE C. Inflammation-related mechanisms in chronic kidney disease prediction, progression, and outcome. *Journal of Immunology Research*, 2018, 2018: 1–16. <https://dx.doi.org/10.1155/2018/2180373>
- [25] GLASTRAS S. J., CHEN H., TEH R., MCGRATH R. T., CHEN J., POLLOCK C. A., WONG M. G., and SAAD S. Mouse models of diabetes, obesity and related kidney disease. *PLoS One*, 2016, 11(8): 1–15. <https://dx.doi.org/10.1371/journal.pone.0162131>
- [26] KANG J., RATAMESS N. A., FAIGENBAUM A. D., and BUSH J. A. Ergogenic Properties of Ketogenic Diets in Normal-Weight Individuals: A Systematic Review. *Journal of the American College of Nutrition*, 2020, 39(7): 665–675. <https://dx.doi.org/10.1080/07315724.2020.1725686>
- [27] GAI Z., WANG T., VISENTIN M., KULLAK-UBLICK G. A., FU X., and WANG Z. Lipid accumulation and chronic kidney disease. *Nutrients*, 2019, 11(4): 1–21. <https://dx.doi.org/10.3390/nu11040722>
- [28] MULLER C. R., AMÉRICO A. L. V., FIORINO P., and EVANGELISTA F. S. Aerobic exercise training prevents kidney lipid deposition in mice fed a cafeteria diet. *Life Science*, 2018, 211: 140–146. <https://dx.doi.org/10.1016/j.lfs.2018.09.017>
- [29] NIGAM P. K., & CHANDRA A. Positive and negative false estimates of serum creatinine. *Interventional Cardiology*, 2017, 9(4): 163–166. <https://dx.doi.org/10.4172/Interventional-Cardiology.1000572>
- [30] HEWITSON T. D., HOLT S. G., and SMITH E. R. Progression of tubulointerstitial fibrosis and the chronic kidney disease phenotype - Role of risk factors and epigenetics. *Frontiers in Pharmacology*, 2017, 8(520): 1–8. <https://dx.doi.org/10.3389/fphar.2017.00520>
- [31] PENG W., TANG Y., TAN L., and QIN W. Crescents and global glomerulosclerosis in Chinese IgA nephropathy patients: A five-year follow-up. *Kidney and Blood Pressure Research*, 2019, 44(1): 103–112. <https://dx.doi.org/10.1159/000498874>
- [32] GREENWOOD A. M., GUNNARSSON R., NEUEN B. L., OLIVER K., GREEN S. J., and BAER R. A. Clinical presentation, treatment and outcome of focal segmental glomerulosclerosis in Far North Queensland Australian adults. *Nephrology*, 2017, 22(7): 520–530. <https://dx.doi.org/10.1111/nep.12816>
- [33] HUANG J., LI Y. Q., WU C. H., ZHANG Y. L., ZHAO S. T., CHEN Y. J., DENG Y. H., XUAN A., and SUN X. D. The effect of ketogenic diet on behaviors and synaptic functions of naive mice. *Brain and Behavior*, 2019, 9(4): 1–12. <https://doi.org/10.1002/brb3.1246>
- [34] NILSSON J., ERICSSON M., JOIBARI M. M., ANDERSON F., CARLSSON L., NILSSON S. K., SJÖDIN A., and BURÉN J. A low-carbohydrate high-fat diet decreases lean mass and impairs cardiac function in pair-fed female C57BL/6J mice. *Nutrition and Metabolism*, 2016, 13(79): 1–12. <http://dx.doi.org/10.1186/s12986-016-0132-8>
- [35] FRIEDMAN M. I., & APPEL S. Energy expenditure and body composition changes after an isocaloric ketogenic diet in overweight and obese men: A secondary analysis of energy expenditure and physical activity. *PLoS One*, 2019, 14(12): 1–14. <https://dx.doi.org/10.1371/journal.pone.0222971>
- [36] ZHANG Q., XU L., XIA J., WANG D., QIAN M., and DING S. Treatment of Diabetic Mice with a Combination of Ketogenic Diet and Aerobic Exercise via Modulations of PPARs Gene Programs. *PPAR Research*, 2018, 2018: 1–13. <https://dx.doi.org/10.1155/2018/4827643>
- [37] DEEMER S. E., PLAISANCE E. P., and MARTINS C. Impact of ketosis on appetite regulation—a review. *Nutrition Research*, 2020, 77: 1–11. <https://dx.doi.org/10.1016/j.nutres.2020.02.010>
- [38] PAOLI A. Ketogenic diet for obesity: Friend or foe? *International Journal of Environmental Research and Public Health*, 2014, 11(2): 2092–2107. <https://dx.doi.org/10.3390/ijerph110202092>
- [39] DUTTA S., & SENGUPTA P. Men and mice: Relating their ages. *Life Science*, 2016, 152: 244–248. <http://dx.doi.org/10.1016/j.lfs.2015.10.02>
- [40] BATCH J. T., LAMSAL S. P., ADKINS M., SULTAN S., and RAMIREZ M. N. Advantages and Disadvantages of the Ketogenic Diet: A Review Article. *Cureus*, 2020, 12(8): 8–15. <https://dx.doi.org/10.7759/cureus.9639>

#### 参考文献:

- [1] 世界卫生组织。肥胖与超重，2020。 <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>

- [2] RISKESDAS. 拉波兰国民基础健康研究。雅加达, 2018. <http://www.kesmas.kemkes.go.id>
- [3] CHOBOT A., GÓROWSKA-KOWOLIK K., SOKOŁOWSKA M. 和 JAROSZ-CHOBOT P. 肥胖与糖尿病-不仅是两个流行病之间的简单联系。糖尿病/代谢研究与评论, 2018, 34 (7) : 1-9。 <https://dx.doi.org/10.1002/dmrr.3042>
- [4] STONE T. W., MCPHERSON M. 和 GAIL DARLINGTON L. 肥胖与癌症: 因果关系的现有假设和新假设。生物医学, 2018, 30 : 14-28。 <https://dx.doi.org/10.1016/j.ebiom.2018.02.022>
- [5] 林雅娜, 陈雅洁, 曹雅洁, 叶文成, 李文洁, 曾宪一和陈洁是台湾中老年人肥胖指数与高血压之间的关系: 一项基于社区的横断面研究。英国医学杂志公开赛, 2019, 9 (10) : 1-8。 <http://dx.doi.org/10.1136/bmjopen-2019-031660>
- [6] CERCATO C. 和 FONSECA F. A. 心血管风险和肥胖。糖尿病与代谢综合症, 2019, 11 (1) : 1-15。 <https://dx.doi.org/10.1186/s13098-019-0468-0>
- [7] ALBUQUERQUE D., NÓBREGA C., MANCO L. 和 PADEZ C. 遗传学和环境对肥胖的贡献。英国医学杂志, 2017, 123 (1) : 159-173。 <http://dx.doi.org/10.1093/bmb/ldx022>
- [8] GOSWAMI J. N. 和 SHARMA S. 关于生酮饮食在癫痫治疗中作用的最新观点。神经精神疾病与治疗, 2019, 15 : 3273-3285。 <http://dx.doi.org/10.2147/NDT.S201862>
- [9] WŁODAREK D. 生酮饮食在神经退行性疾病 (阿尔茨海默氏病和帕金森氏病) 中的作用。营养素, 2019, 11 (169) : 1-11。 <https://dx.doi.org/10.3390/nu11010169>
- [10] IACOVIDES S. 和 MEIRING R. M. 生酮饮食与高碳水化合物, 低脂饮食对睡眠, 认知, 甲状腺功能和心血管健康的影响, 与体重减轻无关: 一项随机对照试验的研究方案。试用, 2018, 19 (1) : 1-9。 <https://dx.doi.org/10.1186/s13063-018-2462-5>
- [11] SHILPA J., 和 MOHAN V. 生酮饮食: 骨头还是骨头? 印度医学研究杂志, 2018, 148 (3) : 251-253。 [https://dx.doi.org/10.4103/ijmr.IJMR\\_1666\\_18](https://dx.doi.org/10.4103/ijmr.IJMR_1666_18)
- [12] SILVARES R. R., DA SILVA PEREIRA E. N. G., FLORES E. E. I., RODRIGUES K. L., SILVA A. R., GONÇALVES-DE-ALBUQUERQUE C. F. 和 DALIRY A. 高脂饮食诱发的代谢综合征大鼠肾脏改变: 内皮功能障碍和抗氧化剂降低防御。糖尿病, 代谢综合症和肥胖: 目标与疗法, 2019, 12 : 1773-1781。 <https://dx.doi.org/10.2147/DMSO.S211253>
- [13] 孙Y., 葛新, 李新, 何洁, 魏新, 杜洁, 孙洁, 李新, X尊, 刘伟, 张宏, 王正.-Y. 和 LI Y. C. 高脂饮食通过诱导氧化应激和线粒体功能障碍来促进肾脏损伤。细胞死亡与疾病, 2020, 11 (10) : 1-14。 <http://dx.doi.org/10.1038/s41419-020-03122-4>
- [14] GERSHUNI V. M., YAN S. L. 和 MEDICI V. 营养性酮症, 用于体重管理和代谢综合征的逆转。当前营养报告, 2018, 7 (3) : 97-106。 <https://dx.doi.org/10.1007/s13668-018-0235-0>
- [15] WEBER D. D., AMINZADEH-GOHARI S., TULIPAN J., CATALANO L., FEICHTINGER R. G. 和 KOFLER B. 生酮饮食在癌症治疗中的作用-我们站在哪里? 分子代谢, 2020, 33 : 102-121。 <https://dx.doi.org/10.1016/j.molmet.2019.06.026>
- [16] SYAHRAYA I., NOVIDA H., HERAWATI L. 和 REJEKI P. S. 高脂肪饮食对小鼠内脏脂肪中解偶联蛋白1表达的影响, 从而减轻了体重。印尼大叶草, 2020, 56 (3) : 223-228。 <https://dx.doi.org/10.20473/fmi.v56i3.24576>
- [17] GUPTA L., KHANDELWAL D., KALRA S., GUPTA P., DUTTA D. 和 AGGARWAL S. 内分泌失调的生酮饮食: 当前观点。研究生医学杂志, 2017, 63 (4) : 242-251。 [https://dx.doi.org/10.4103/jpgm.JPGM\\_16\\_17](https://dx.doi.org/10.4103/jpgm.JPGM_16_17)
- [18] MULLER C. R., LEITE A. P. O., YOKOTA R., PEREIRA R. O., AMERICO A. L. V., NASCIMENTO N. R. F., EVANGELISTA F. S., FARAH V., FONTELES M. C. 和 FIORINO P. 成年大鼠的功能障碍。营养前沿, 2019, 6 (60) : 1-8。 <https://dx.doi.org/10.3389/fnut.2019.00060>
- [19] RAYNER H., MILFORD D. 和 THOMAS M. 肾脏解剖与生理学。于: RAYNER H. C., THOMAS M. 和 MILFORD D. 了解肾脏疾病。施普林格国际出版社, 2016 : 1-10。 [https://doi.org/10.1007/978-3-319-23458-8\\_1](https://doi.org/10.1007/978-3-319-23458-8_1)
- [20] KRSTIC D., TOMIC N., RADOSAVLJEVIC B., AVRAMOVIC N., DRAGUTINOVIC V., SKODRIC S. R. 和 COLOVIC M. 肾功能的生化标记。当前药物化学, 2016, 23 (19) : 2018-2040。 <https://doi.org/10.2174/0929867323666160115130241241>
- [21] ZHANG W. R. 和 PARIKH C. R. 急性和慢性肾脏病的生物标志物。生理学年度评论, 2019, 81 : 309-333。 <https://dx.doi.org/10.1146/annurev-physiol-020518-114605>
- [22] EIYA B. 和 OSAKUE J. 高脂生酮饮食对威士达白化病大鼠某些心血管和肾脏参数的影响高脂生酮饮食对威士达白化病大鼠某些心血管和肾脏参数的影响。国际生物化学杂志, 2019, 12 (6) : 2703-2712。 <https://dx.doi.org/10.4314/ijbcs.v12i6.19>
- [23] ARSYAD A., IDRIS I., RASYID A. A., USMAN R. A., FARADILLAH K. R., LATIF W. O. U., LUBIS Z. I., AMINUDDIN A., YUSTISIA I. 和 DJABIR Y. Y. 长期生酮饮食会引起代谢性酸中毒, 贫血和氧化健康威士达大鼠的压力。营养与代谢杂志, 2020, 2020 : 1-7。 <https://dx.doi.org/10.1155/2020/3642035>
- [24] MIHAI S., CODRICI E., POPESCU I. D., ENCIU A.-M., ALBULESCU L., NECULA L. G., MAMBET C., ANTON G. 和 TANASE C. 慢性肾脏疾病预测中与炎



- 症相关的机制, 进展和结果。免疫学研究杂志, 2018, 2018 : 1-16。 <https://dx.doi.org/10.1155/2018/2180373>
- [25] GLASTRAS S. J., CHEN H., TEH R., MCGRATH R. T., CHEN J., POLLOCK C. A., WONG M. G. 和 SAAD S. 糖尿病, 肥胖症和相关肾脏疾病的小鼠模型。公共科学图书馆, 2016, 11 ( 8 ) : 1-15。 <https://dx.doi.org/10.1371/journal.pone.0162131>
- [26] KANG J., RATAMESS N. A., FAIGENBAUM A. D. 和 BUSH J. A. 正常体重个体中生酮饮食的人生成特性: 系统评价。美国营养学院学报, 2020, 39 ( 7 ) : 665-675。 <https://dx.doi.org/10.1080/07315724.2020.1725686>
- [27] GAI Z., WANG T., VISENTIN M., KULLAK-UBLICK G.A., FU X. 和 WANG Z. 脂质蓄积与慢性肾脏疾病。营养素, 2019, 11 ( 4 ) : 1-21。 <https://dx.doi.org/10.3390/nu11040722>
- [28] MULLER C. R., AMÉRICOA. L. V., FIORINO P. 和 EVANGELISTA F. S. 有氧运动训练可防止喂食自助饮食的小鼠肾脏脂质沉积。生命科学, 2018, 211 : 140-146。 <https://dx.doi.org/10.1016/j.lfs.2018.09.017>
- [29] NIGAM P. K. 和 CHANDRA A. 血清肌酐的正误估计和负估计。介入心脏病学, 2017, 9 ( 4 ) : 163-166。 <https://dx.doi.org/10.4172/Interventional-Cardiology.1000572>
- [30] HEWITSON T. D., HOLT S. G. 和 SMITH E. R. 肾小管间质纤维化的进展和慢性肾脏疾病表型-危险因素和表观遗传学的作用。药理学前沿, 2017, 8 ( 520 ) : 1-8。 <https://dx.doi.org/10.3389/fphar.2017.00520>
- [31] PENG W., TANG Y., TAN L. 和 QIN W. 中国抗体肾病患者新月与全球肾小球硬化: 五年随访。肾脏与血压研究, 2019, 44 ( 1 ) : 103-112。 <https://dx.doi.org/10.1159/000498874>
- [32] GREENWOOD A. M., GUNNARSSON R., NEUEN B. L., OLIVER K., GREEN S. J. 和 BAER R. A. 澳大利亚北昆士兰州成年人的局灶节段性肾小球硬化症的临床表现, 治疗和结局。肾脏病学, 2017, 22 ( 7 ) : 520-530。 <https://dx.doi.org/10.1111/nep.12816>
- [33] 黄健, 李玉清, 吴昌华, 张玉玲, 赵士腾, 陈玉洁, 邓玉华, 宣爱, 孙新德。生酮饮食对幼稚小鼠行为和突触功能的影响。脑与行为, 2019, 9 ( 4 ) : 1-12。 <https://doi.org/10.1002/brb3.1246>
- [34] NILSSON J., ERICSSON M., JOIBARI M. M., ANDERSON F., CARLSSON L., NILSSON S. K., SJÖDIN A. 和 BURÉN J. 低碳水化合物高脂饮食会降低瘦肉质量并损害成对的心功能。喂养的雌性C57BL / 6J 小鼠。营养与代谢, 2016, 13 ( 79 ) : 1-12。 <http://dx.doi.org/10.1186/s12986-016-0132-8>
- [35] FRIEDMAN M. I. 和 APPEL S. 超重和肥胖男性等热量生酮饮食后能量消耗和身体组成发生变化: 能量消耗和身体活动的二级分析。公共科学图书馆一期, 2019, 14 ( 12 ) : 1-14。 <https://dx.doi.org/10.1371/journal.pone.0222971>
- [36] 张强, 徐露, 夏佳, 王丹, 钱敏, 丁丁。通过调节PPARs基因程序, 结合生酮饮食和有氧运动治疗糖尿病小鼠。PPAR研究, 2018, 2018 : 1-13。 <https://dx.doi.org/10.1155/2018/4827643>
- [37] DEEMER S. E., PLAISANCE E. P. 和 MARTINS C. 酮症对食欲调节的影响-综述。营养研究, 2020, 77 : 1-11。 <https://dx.doi.org/10.1016/j.nutres.2020.02.010>
- [38] PAOLI A. 肥胖的生酮饮食: 是敌是友? 国际环境研究与公共卫生杂志, 2014, 11 ( 2 ) : 2092-2107。 <https://dx.doi.org/10.3390/ijerph110202092>
- [39] DUTTA S. 和 SENGUPTA P. 男人和老鼠: 与年龄相关。生命科学, 2016, 152 : 244-248。 <http://dx.doi.org/10.1016/j.lfs.2015.10.02>
- [40] BATCH J. T., LAMSAL S. P., ADKINS M., SULTAN S. 和 RAMIREZ M. N. 生酮饮食的利与弊: 评论文章。治愈者, 2020, 12 ( 8 ) : 8-15。 <https://dx.doi.org/10.7759/cureus.9639>

# Long-Team Ketogenic Diet Alters Kidney Function through Increasing Serum Creatinine Levels in Mice

## ORIGINALITY REPORT

18%

SIMILARITY INDEX

15%

INTERNET SOURCES

11%

PUBLICATIONS

0%

STUDENT PAPERS

## PRIMARY SOURCES

- 1 Qiuli Shan, Hongmei Li, Ningning Chen, Fan Qu, Jing Guo. "  
Understanding the Multiple Effects of PCBs on Lipid Metabolism  
", Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 2020  
Publication <1 %
- 2 [physoc.onlinelibrary.wiley.com](https://physoc.onlinelibrary.wiley.com)  
Internet Source <1 %
- 3 [pubmed.ncbi.nlm.nih.gov](https://pubmed.ncbi.nlm.nih.gov)  
Internet Source <1 %
- 4 [www.fbn-dummerstorf.de](https://www.fbn-dummerstorf.de)  
Internet Source <1 %
- 5 [www.ncbi.nlm.nih.gov](https://www.ncbi.nlm.nih.gov)  
Internet Source <1 %
- 6 Claude Emond, Michael J DeVito, Janet J Diliberto, Linda S Birnbaum. "The Influence of Obesity on the Pharmacokinetics of Dioxin in

# Mice: An Assessment Using Classical and PBPK Modeling", Toxicological Sciences, 2018

Publication

---

7	<a href="https://escholarship.org">escholarship.org</a> Internet Source	<1 %
8	<a href="https://link.springer.com">link.springer.com</a> Internet Source	<1 %
9	<a href="https://pure-oai.bham.ac.uk">pure-oai.bham.ac.uk</a> Internet Source	<1 %
10	<a href="https://repositorio.cientifica.edu.pe">repositorio.cientifica.edu.pe</a> Internet Source	<1 %
11	Yueh-Hsiung Kuo, Cheng-Hsiu Lin, Chun-Ching Shih. " Antidiabetic and Antihyperlipidemic Properties of a Triterpenoid Compound, Dehydroeburicoic Acid, from in Vitro and in Streptozotocin-Induced Mice ", Journal of Agricultural and Food Chemistry, 2015 Publication	<1 %
12	Zhongjing Lin, Xiaoxia Pan, Ke Mao, Qin Jiao, Yanwei Chen, Yisheng Zhong, Yu Cheng. "Quantitative evaluation of retinal and choroidal changes in Fabry disease using optical coherence tomography angiography", Lasers in Medical Science, 2021 Publication	<1 %
13	<a href="https://c.wanfangdata.com.cn">c.wanfangdata.com.cn</a> Internet Source	<1 %

---

14	<a href="http://ejournal.unikama.ac.id">ejournal.unikama.ac.id</a> Internet Source	<1 %
15	<a href="http://eprints.bournemouth.ac.uk">eprints.bournemouth.ac.uk</a> Internet Source	<1 %
16	<a href="http://edoc.ub.uni-muenchen.de">edoc.ub.uni-muenchen.de</a> Internet Source	<1 %
17	<a href="http://www.holisticperformancenutrition.com">www.holisticperformancenutrition.com</a> Internet Source	<1 %
18	<a href="http://www.mdrf.in">www.mdrf.in</a> Internet Source	<1 %
19	<a href="http://www.mysciencework.com">www.mysciencework.com</a> Internet Source	<1 %
20	<a href="http://www.science.gov">www.science.gov</a> Internet Source	<1 %
21	<a href="http://www.wjgnet.com">www.wjgnet.com</a> Internet Source	<1 %
22	Akiko Hanyuda, Bernard A. Rosner, Janey L. Wiggs, Walter C. Willett, Kazuo Tsubota, Louis R. Pasquale, Jae H. Kang. "Low-carbohydrate-diet scores and the risk of primary open-angle glaucoma: data from three US cohorts", Eye, 2020 Publication	<1 %
23	<a href="http://Www.arcjournals.org">Www.arcjournals.org</a> Internet Source	<1 %

24

[www.australianpharmacist.com.au](http://www.australianpharmacist.com.au)

Internet Source

<1 %

---

25

Marco Prunotto, Gian Marco Ghiggeri, Giovanni Candiano, Pierre Lescuyer, Denis Hochstrasser, Solange Moll. "Urinary Proteomics and Drug Discovery in Chronic Kidney Disease: A New Perspective", Journal of Proteome Research, 2011

Publication

<1 %

---

26

Yingchun Han, Bryan Glueck, David Shapiro, Aaron Miller, Sanjoy Roychowdhury, Gail A. M. Cresci. "Dietary Synbiotic Supplementation Protects Barrier Integrity of Hepatocytes and Liver Sinusoidal Endothelium in a Mouse Model of Chronic-Binge Ethanol Exposure", Nutrients, 2020

Publication

<1 %

---

27

[dspace.cuni.cz](http://dspace.cuni.cz)

Internet Source

<1 %

---

28

[mafiadoc.com](http://mafiadoc.com)

Internet Source

<1 %

---

29

[www.nature.com](http://www.nature.com)

Internet Source

<1 %

---

30

[jurnal.upnyk.ac.id](http://jurnal.upnyk.ac.id)

Internet Source

<1 %

---

31

[www.mayoclinic.org](http://www.mayoclinic.org)

Internet Source

<1 %

32

[e-journal.unair.ac.id](http://e-journal.unair.ac.id)

Internet Source

<1 %

33

[pubs.rsc.org](http://pubs.rsc.org)

Internet Source

<1 %

34

[www.tandfonline.com](http://www.tandfonline.com)

Internet Source

<1 %

35

[annals-general-psychiatry.biomedcentral.com](http://annals-general-psychiatry.biomedcentral.com)

Internet Source

<1 %

36

[eprints.nottingham.ac.uk](http://eprints.nottingham.ac.uk)

Internet Source

<1 %

37

[indjst.org](http://indjst.org)

Internet Source

<1 %

38

[ir4.rutgers.edu](http://ir4.rutgers.edu)

Internet Source

<1 %

39

[iupress.istanbul.edu.tr](http://iupress.istanbul.edu.tr)

Internet Source

<1 %

40

[pureportal.coventry.ac.uk](http://pureportal.coventry.ac.uk)

Internet Source

<1 %

41

[www.p53.cn](http://www.p53.cn)

Internet Source

<1 %

42

[www.pubfacts.com](http://www.pubfacts.com)

Internet Source

<1 %

43 Maude Bordeleau, Lourdes Fernández de Cossío, M. Mallar Chakravarty, Marie-Ève Tremblay. "From Maternal Diet to Neurodevelopmental Disorders: A Story of Neuroinflammation", *Frontiers in Cellular Neuroscience*, 2021  
Publication <1 %

---

44 Ze-Bing Zhu, Ke Song, Wei-Jun Huang, Hui Li et al. "Si-Miao-Yong-An (SMYA) Decoction May Protect the Renal Function Through Regulating the Autophagy-Mediated Degradation of Ubiquitinated Protein in an Atherosclerosis Model", *Frontiers in Pharmacology*, 2020  
Publication <1 %

---

45 [basictranslational.onlinejacc.org](http://basictranslational.onlinejacc.org)  
Internet Source <1 %

---

46 [doaj.org](http://doaj.org)  
Internet Source <1 %

---

47 [doctoronly.co.il](http://doctoronly.co.il)  
Internet Source <1 %

---

48 [hkjpaed.org](http://hkjpaed.org)  
Internet Source <1 %

---

49 [investigacion.us.es](http://investigacion.us.es)  
Internet Source <1 %

---

50 [motionstructures.tju.edu.cn](http://motionstructures.tju.edu.cn)

Internet Source

<1 %

51

[thieme-connect.com](https://thieme-connect.com)

Internet Source

<1 %

52

[womensmidlifehealthjournal.biomedcentral.com](https://womensmidlifehealthjournal.biomedcentral.com)

Internet Source

<1 %

53

[www.elsevier.es](https://www.elsevier.es)

Internet Source

<1 %

54

[www.jyoga.com.tw](https://www.jyoga.com.tw)

Internet Source

<1 %

55

[www.legs.cnrs-gif.fr](https://www.legs.cnrs-gif.fr)

Internet Source

<1 %

56

[www.researchgate.net](https://www.researchgate.net)

Internet Source

<1 %

57

[www.stressmarq.com](https://www.stressmarq.com)

Internet Source

<1 %

58

[zootax.com.cn](https://zootax.com.cn)

Internet Source

<1 %

59

"Clinical and Preclinical Models for Maximizing Healthspan", Springer Science and Business Media LLC, 2020

Publication

<1 %

60

Keene, D.L.. "A Systematic Review of the Use of the Ketogenic Diet in Childhood Epilepsy", Pediatric Neurology, 200607

<1 %



---

61 Parmer, S.S.. "A comparison of renal function between open and endovascular aneurysm repair in patients with baseline chronic renal insufficiency", Journal of Vascular Surgery, 200610 <1 %  
Publication

---

62 [cris.fau.de](http://cris.fau.de) <1 %  
Internet Source

---

63 [ijp.iranpath.org](http://ijp.iranpath.org) <1 %  
Internet Source

---

64 [journal.usm.my](http://journal.usm.my) <1 %  
Internet Source

---

65 [masd.unbosque.edu.co](http://masd.unbosque.edu.co) <1 %  
Internet Source

---

66 [phabricator.wikimedia.org](http://phabricator.wikimedia.org) <1 %  
Internet Source

---

67 [ueaeprints.uea.ac.uk](http://ueaeprints.uea.ac.uk) <1 %  
Internet Source

---

68 [www.e3s-conferences.org](http://www.e3s-conferences.org) <1 %  
Internet Source

---

69 [www.geneticsmr.com](http://www.geneticsmr.com) <1 %  
Internet Source

---

70 [www.ifgdg.org](http://www.ifgdg.org) <1 %  
Internet Source

---

71	<a href="http://www.jorgenflor.no">www.jorgenflor.no</a> Internet Source	<1 %
72	<a href="http://www.myfoodresearch.com">www.myfoodresearch.com</a> Internet Source	<1 %
73	<a href="http://www.vo2max.com.cn">www.vo2max.com.cn</a> Internet Source	<1 %
74	<a href="http://www2.memmm.mec.kansai-u.ac.jp">www2.memmm.mec.kansai-u.ac.jp</a> Internet Source	<1 %
75	<a href="http://wwwnc.cdc.gov">wwwnc.cdc.gov</a> Internet Source	<1 %
76	"International Academy of Cardiology Annual Scientific Sessions 2015. 20th World Congress on Heart Disease Vancouver, B.C., Canada, July 25-27, 2015: Abstracts", <i>Cardiology</i> , 2015 Publication	<1 %
77	Wendy Cunningham, Dianne Hyson. "The Skinny on High - Protein, Low - Carbohydrate Diets", <i>Preventive Cardiology</i> , 2007 Publication	<1 %
78	R Bhidayasiri. "Chorea and related disorders", <i>Postgraduate Medical Journal</i> , 2004 Publication	<1 %
79	Sarah K. Wise, Sandra Y. Lin, Elina Toskala, Richard R. Orlandi et al. "国际过敏与鼻科学共识声明：变应性鼻炎", <i>International Forum of Allergy &amp; Rhinology</i> , 2019	<1 %

## Publication

---

Exclude quotes      On

Exclude bibliography      On

Exclude matches      Off

# Long-Team Ketogenic Diet Alters Kidney Function through Increasing Serum Creatinine Levels in Mice

---

GRADEMARK REPORT

---

FINAL GRADE

**/100**

GENERAL COMMENTS

**Instructor**

---

PAGE 1

---

PAGE 2

---

PAGE 3

---

PAGE 4

---

PAGE 5

---

PAGE 6

---

PAGE 7

---

PAGE 8

---