The Effects of Kefir and Jicama Synbiotic Administration on White Rat Serum Cortisol Levels After Subtotal Nephrectomy

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Abstract. Changes in the kidneys can lead to increased blood pressure, which can be followed by an increase in cortisol levels. Subtotal nephrectomy is one of the methods to provide animal models of hypertension. The combination of kefir milk and jicama as a synbiotic drink is expected to maintain cortisol under normal levels in hypertensive conditions. Aim: This study aims to determine the effect of kefir and jicama synbiotic beverage on rats' serum cortisol levels after a subtotal nephrectomy procedure. Methods: Male Wistar rats were divided into five groups, i.e. a group of subtotal nephrectomy, sham group, and three synbiotic groups receiving subtotal nephrectomy procedure and synbiotics with differences in composition (Syn 1, Syn 2, and Syn 3). The serum cortisol levels were measured with ELISA after a month of kefir and jicama synbiotic administration. The results were analyzed statistically using one-way ANOVA. Results: The serum cortisol levels (ng/mL) were 165.49 ± 33.73, 150.90 ± 51.54, 158.77 ± 27.17, 119.64 ± 79.20, and 168.06 ± 19.19 respectively for subtotal nephrectomy, sham group, Syn 1, Syn 2, and Syn 3 groups. The one-way ANOVA statistical analysis obtained a $p = 0.386$, which showed no significant differences between groups. The administration of kefir and jicama as a synbiotic beverage has no significant effects on rat's serum cortisol levels after subtotal nephrectomy.

Keywords: Synbiotics · Kefir · Jicama · Cortisol · Subtotal nephrectomy

1 Introduction

According to the WHO data, approximately 972 million people in the world (26.4%) have hypertension. In 2025 it is predicted that there will be an increase in the number of people with hypertension to 29.2%. Of the 972 million hypertensive individuals,

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639 million are in developing countries including Indonesia while 333 million are in developed countries [1]. Hypertension is a major health problem due to its high incidence globally. About 7.5 million deaths worldwide are caused by high blood pressure [2]. In fact, hypertension is the most significant risk factor in cardiovascular mortality and ranks third as the cause of lifestyle changes in adults [3]. Stress that occurs in hypertensive patients can be followed by increased cortisol levels [4]. Such increase will cause elevated blood pressure. There is a dominant role of the autonomic nervous system through the afferent and efferent vagus systems, the adrenaline and cortisol hormones through the hypothalamic-adenohypophysis-adrenal axiom, and local and circulatory inflammatory cytokines [5].

Given the high number of people with hypertension and the many complications that can be caused by hypertension, it is necessary to administer appropriate treatment. The procedure of hypertension therapy can be established pharmacologically or non-pharmacologically. One of the non-pharmacological therapies under development is synbiotics. Synbiotics are components consisting of probiotics and prebiotics. Probiotics are living things that have benefits for the health of the body [6]. One source of probiotics comes from kefir grain. The diversity of microbiota types in kefir makes it have more efficacy than other probiotic drinks [7]. Numerous studies have proven that giving probiotics can lower blood pressure through several pathways [8]. Jicama has a prebiotic content in the form of inulin and fructo-oligosaccharide (FOS) [9, 10]. Research shows that prebiotics have the ability to reduce the risk of hypertension through a variety of mechanisms. One of them is by reducing lipid and cholesterol levels [11]. A decrease in blood pressure is expected to result in correspondingly reduced cortisol levels.

2 Method

The subjects in the study were 24 male rats of Wistar strain (Rattus norvegicus) aged 2–3 months with a weight of 100–300 g. The rats were divided into five study groups, the subtotal nephrectomy group, sham group, and 3 synbiotic groups given subtotal nephrectomy and synbiotics with different compositions. The three treatment groups were the group that received 85% kefir and 15% jicama (Syn 1), 75% kefir and 25% jicama (Syn 2), and 65% kefir and 35% jicama (Syn 3). The serum cortisol levels were checked with ELISA after a month of synbiotic administration. The cortisol examination used the ELISA method with the ELISA kit from Calbiotech Lot COS5813. The results were analyzed statistically using the one-way ANOVA.

3 Result and Discussion

The research has obtained ethical clearance from the ethics commission of the Faculty of Medicine, Universitas Islam Indonesia. The subjects in this study received treatment in the form of subtotal nephrectomy surgery aimed at raising blood pressure. This study obtained the data on serum cortisol levels with the highest in the group of rats that received the subtotal nephrectomy treatment, reaching 15.00 ± 2.8 ng/mL. Meanwhile, the lowest serum cortisol levels were in the Syn 2 group with 9.50 ± 5.10 ng/mL. The Syn 2 group was the group administered with synbiotics in a combination of 75% kefir milk

Table 1. Cortisol levels

Subtotal nephrectomy	15.00±2.8	0.839
Sham	11.83±2.40	
Syn 1	12.00±4.02	
Syn 2	9.50±5.10	
Syn 3	13.25±3.42	

and 25% jicama, indicating a mid-combination dose. The One-Way ANOVA statistical analysis resulted in a value of $p = 0.839$ which indicated that there were no significant differences among the groups.

4 Discussion

The results of this study show differences in the cortisol levels among the five treatment groups although the results are statistically insignificant. From Table 1., it can be seen that the cortisol levels of the subtotal nephrectomy group are the highest among the five treatment groups. In hypertensive conditions due to kidney disorders, the signal of renin angiotensin aldosterone becomes impaired. Cortisol levels may increase in hypertensive conditions [12], which is seen in the groups with the subtotal nephrectomy treatment. A previous study [4] also shows an increase in the serum cortisol of patients with primary hypertension. Serum cortisol levels are inversely proportional to the value of glomerular filtration rate in primary hypertension.

The sham treatment group has serum cortisol levels that are the normal standard in this study as the rats in this group receive no treatment other than a sham surgery. Based on this study, there are no significant differences in the serum cortisol levels among the groups. Of the three treatment groups in this study, the Syn 2 group has the lowest average level.

According to previous research [13], prebiotics are important for stimulating the growth of probiotics, which in the study is the normal flora of the intestine. The availability of prebiotics is sufficient to improve the function of probiotics and normal intestinal flora. Probiotics in sufficient quantities and optimal function are able to provide the expected health effects. Inulin in the jicama has been considered a prebiotic that has health effects on the body. A study mentions that Inulin as a prebiotic is able to form short-chain fatty acids that are beneficial for metabolism [14]. The combination of probiotics and prebiotics in a synbiotic product should be in an appropriate comparison. The right combination of a synbiotic product can provide health effects, such as to reduce atopic dermatitis in children [15]. In this study, the combination that gives the most optimal results is 35% prebiotic combined with 65% probiotic. Although statistically it is not more meaningful than the other combinations, the results provide a foundation that prebiotic and probiotic compositions are important to take into account.

5 Conclusion

There are no significant differences in the serum cortisol levels of hypertensive rats given a combination of kefir and jicama.

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Author's Contribution. MDP, RLA, and TN formulated the concept; MDP and TN analyzed; MDP, TN, and QUK wrote; EB, RP, MAS, HAF, BAP, CNNA, SR, MHAB, CBS, SSN, and AZND collected the data.

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