Since 1943, alloxan has been widely used to induce diabetes by selectively blocking secretion of insulin, because it has a strong oxidizing power which destroys cells in the pancreas and reduces the area of cells [32]. Cooperstein and Watkins [33] claimed the mechanism of alloxan to induce diabetes as follows: Alloxan is bound to glucose in the cellular membrane of β-cell or is present around the glucose. Thus, it is bound to sulfhydryl protein which may play the important role for the general functions of the β-cell, which increases the penetration into the cellular membrane. Due to the increased penetration, the β-cells are destroyed and the diabetes is induced [34]. After all, compounds with a strong oxidizing power such as alloxan induce type 1 diabetes which is insulin-dependent diabetes mellitus characterized by blocking the production and secretion of insulin in the β-cell.

The most important function of β-cells is to synthesize, store and secret insulin which is the hormone to lower the blood glucose levels. When the blood glucose level is high, the β-cell secrets and produces insulin at the same time. The cellular membrane of the β-cell has voltage-gated calcium channels and ATP-sensitive potassium channels. As the ATP-sensitive potassium channel usually opens, potassium diffuses out of the cell depending on the concentration gradient across the membrane. If the glucose level is high outside the cell, the glucose is imported through Glucose Transporter 2 (GLUT2). Because the β-cell phosphorylates the glucose using the glucokinase, the metabolism occurs only in the conditions with physiological glucose levels or higher glucose levels. ATP is produced through the metabolism of glucose, the ATP/ ADP ratio is increased. When the ATP/ADP ratio is high, the ATP-sensitive potassium channel is closed and thus potassium cannot be diffuse. Since the potassium is accumulated inside the cells, the membrane potential becomes more positive and thus the closed voltage-gated calcium channel opens. It results in calcium influx along the concentration gradient of calcium. Vesicles containing insulin are transported to the edge of the cells and then insulin is secreted through the fusion with cell membrane (exocytosis) [35]. β-cells promote the metabolism of glucose through secretion of insulin and thus produce ATP. However, damaged β-cells increase Glu levels in the blood. If the diabes is not properly treated, it develops into diabetes complications such as diabetic neuropathy [36]. If patients with type 1 diabetes are not properly treated, it develops into overt diabetic neuropathy in 80 % of patients. In the case of patients with type 2 diabetes, it develops into overt diabetic neuropathy in 20 – 40 % of patients after 15 years [37]. Various mechanisms including metabolic factors such as high blood glucose levels, hematological factors and genetic predisposing factors are involved in the process of development into the diabetic neuropathy [38,39]. In general, blood glucose levels are determined by supply of glucose from the outside and changes in using glucose in cells. Even if the rate of using glucose is drastically increased, blood glucose levels are relatively strictly controlled within a certain range. It does not only prevent various acute or chronic complications caused by hyperglycemia or hypoglycemia, but also minimizes the effects on organs which use glucose as a major energy source [40]. Various hormones and factors in the nervous system are involved in such control over glucose levels. In the renal, homeostasis of glucose is regulated through a variety of mechanisms including production of glucose, use of glucose and renal re-absorption due to the effects of these factors [41].

Creatinine (CRE) is an energy that is used for muscle contraction. When creatine is

inefficiently dehydrated in the muscles, it is secreted into the blood as a final metabolite and then excreted in the renal [42, 43]. Some of CRE is excreted to the renal tubule and is not re-absorbed after it is filtered in glomerulus of the renal. Thus, blood CRE levels are being used as an indicator of renal functions. Increases in CRE levels represent substantial renal defects. Results of experiments indicate that blood CRE level is high in a diabetic rabbit model but the blood CRE level tends to decrease in a diabetic rabbit model undergoing the UBI treatment.

In normal people, proteins are metabolized and most of them are finally excreted as urea in the renal. Urea is excreted through the renal as the final product of protein and amino acid metabolisms. BUN is blood urea nitrogen and it is mostly filtered and excreted in glomerulus of the renal. However, some of BUN is re-absorbed depending on the water contents in the body, which is affected by amounts of protein intake, amounts of urine and gastrointestinal bleeding. Because blood urea level is high when the renal function is poor, blood BUN level is one of indicators evaluating renal functions. The results of experiments indicate that blood BUN level is high in a diabetic rabbit model but BUN level tends to decrease in the diabetic rabbit model undergoing the UBI treatment. In addition, purine is one of building blocks of nucleic acids (DNA and RNA) included in the nucleus of the cell and it is broken down into UA as a final product in the body. It is mainly filtered in the renal and excreted in the urine. If the UA level is elevated in the blood because UA is excessively produced or is not properly excreted, urate is accumulated in the joint and surrounding soft tissues. Renal functions decline and the abilities to filter the blood are reduced. Thus, gout occurs with increasing UA levels. However, in this study, our results indicate that UA levels are increased in a diabetic rabbit model induced by alloxan injection but increased UA levels do not cause gout.

5 Conclusions

The results of experiments confirm that the β-cell is damaged by alloxan injection. Since insulin is not released due to damage of β-cell, blood Glu levels are elevated. However, blood Glu level is reduced in the diabetic rabbits undergoing the UBI treatment. The reason why Glu levels are reduced is that the UBI treatment promotes the re-esterification process by facilitating the metabolism of glucose, which increases glycerol 3-phosphate produced from glucose. In addition, the renal plays an important role in the metabolism of glucose. As shown in the results of experiments, the renal tissue is observed by naked eyes and many tissues of the renal are damaged. Thus, it does not properly play roles. In addition, results of hematological analysis indicate that CRE and UA levels indicating renal functions are high. However, as the renal is not damaged in a diabetic rabbit model undergoing the UBI treatment, it can properly play roles. In addition, CRE and UA levels indicating renal function are also low. Therefore, as the UBI treatment can lower the blood Glu levels and prevent the damage of the renal, liver and pancreas, it is found that the UBI treatment is very effective in the diabetes.

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