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Antidiabetic effects of the Platelet Rich Plasma (PRP): A Review

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Abstract

Diabetes Mellitus (DM) is a metabolic illness that manifests as elevated blood glucose levels (hyperglycemia) as a result of kidney failure, particularly in insulin-producing cells. Platelet Rich Plasma is one of the treatments for hyperglycemia that takes a cutting-edge approach to cell regeneration and has attracted substantial attention in recent years (PRP). PRP can accelerate cell proliferation due to the large number of bioactive molecules found in PRP, the majority of which are platelet-derived growth factor (PDGF) protein, transforming growth factor (TGF-), vascular endothelial growth factor (VEGF), epidermal growth factor (EGF), insulin-like growth factor (IGF), and fibroblast growth factor (FGF). This paper does a literature search or conducts a review of published research articles. Search for publications using the keywords PRP and DM or blood sugar levels in Google Scholar and Pubmed. The time period covered by the criterion for papers published in the recent five years is from 2017 to 2021. According to the literature search, there was three research examining the effect of PRP on blood sugar levels in the diabetic model, all of which used experimental animals. According to the literature review, PRP is a viable alternative in the treatment of diabetes mellitus that has a reasonably efficient effect on decreasing blood glucose levels.

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INTRODUCTION

Diabetes Mellitus (DM) is a metabolic illness that manifests as an increase in blood glucose levels (hyperglycemia) due to the pancreas's failure to generate insulin, particularly in -cells. When someone suffers from hyperglycemia as a result of insulin resistance, the process of transferring GLUT-4 from the cell to the plasma membrane is disrupted, preventing the glucose regulation mechanism from entering the cell [1].

According to WHO estimates, DM will increase the number of sufferers, particularly adults, from 34.7 percent in 1980 to 8.5 percent in 2014. According to the International Diabetes Federation (IDF), diabetes mellitus (DM) increased quicker in developing nations than in developed ones in 2015 due to increasing age and unhealthy lifestyle changes. Indonesia, for instance, ranks sixth in terms of diabetes mellitus (DM) sufferers. According to the WHO, the number of persons living with diabetes in Indonesia would increase from 8.4 million in 2000 to 21.3 million in 2030, whereas the IDF projects that the rate of DM patients will increase from 7.0 million in 2009 to 12 million in 2030. [2].

Pancreas or islet transplantation is utilised as a substitute for exogenous insulin administration [3]. However, this technique is associated with a number

of complications, including the danger of major invasive surgery and immunosuppressive therapy side effects [4].

Specific alternative methods for producing cells from endogenous sources must be discovered as a means of developing DM treatment. This is to avoid difficulties associated with tissue matching (transplantation) and surgery [5].

Numerous renewal strategies have been explored to date for inducing -cell regeneration by activation of residual -cell proliferation (neo-genesis), through de novo islet generation from pancreatic progenitor cells, as well as transdifferentiation and cell conversion of non-cells in the pancreas. This induction approach is the most straightforward, direct, and less invasive method of increasing cell mass.

Development Factors (GFs) are naturally occurring biological mediators that regulate cell growth and differentiation and are involved in the repair and regeneration of tissue [6]. Recently, it was discovered that long-term injection of low-dose EGF caused cell neogenesis and differentiation of ductal cells into cells in DM mice [7]. The platelets contribute the greatest amount of GF [8].

PRP is a treatment that provides high concentrations of autologous GF [9]. PRP contains autologous platelet concentrations that are three to five times those of whole blood platelets [10]. PRP therapy is a relatively new regenerative medicine method that has garnered substantial attention in recent years [11].

Platelet Rich Plasma (PRP) is a blood product that contains components of red, white, and platelet blood cells. Plasma is composed of organic and inorganic molecules and ions that collectively perform the functions of other substances. Centrifugation is used to extract platelet-rich plasma. Platelets are 20 times more abundant in PRP than in blood and contain more protein. Because PRP contains bioactive compounds that are known to serve as growth factors in tissues [12, 13], it can accelerate proliferation.

El Tahawy et al. [14] have shown that the use of PRP in the treatment of DM rats for the regeneration response in the pancreas organ can stimulate the production of new lobes and trigger tissue, ductal cell, and cell repair or formation acinar.

Platelet-Derived Growth Factor is the most abundant growth factor in PRP (PDGF). At the same time, PDGF acts mitogenically and chemotactically to activate angiogenic cells and generate mesenchymal cells, which are driven to proliferate fibroblasts and increase collagen in the tissue by Transforming GF-. Then, Insulin-Like Growth Factor (IGF) stimulates fibroblast proliferation and differentiation, collagen synthesis, and then an increase in fibroblast proliferation via Fibroblast Growth Factor (FGF), while Vascukar Endothelial Growth Factor (VEGF) stimulates angiogenesis and tissue regeneration [15].

PRP has been identified as a therapeutic strategy in numerous medical research studies. PRP may contribute to the enhancement of structural alterations in the endocrine pancreas during healing, particularly in diabetic disorders.

METHODOLOGY

This is research that employs the method of a literature study or a literature review. A literature review is a complete summary of the research that has been conducted on a particular subject in order to demonstrate to the reader what is already known about the subject and what is unknown, to derive rationale from previously conducted research, or to generate new research ideas.

Inclusion Criteria

The inclusion criteria can be seen in Table 1:

Table 1 shows the inclusion criteria of this research, including the time, type of article, and theme of the article.

Exclusion Criteria

The exclusion criteria can be seen in Table 2:

The data for this study was derived from research that was conducted and published in international online publications. The researchers conducted this investigation by searching for online research articles using the Google Scholar and PubMed search engines. The journal flow can be seen in Figure 1:

RESULTS AND DISCUSSION

A review of the literature revealed three research examining the effect of PRP on DM, all of which were conducted on experimental animals. The PRP dosages utilised varied. Each test obtained through this literature review has a unique dose and time of investigation - they are not interchangeable.

Zarin et al. [16] conducted research to determine the effect of PRP on impaired glucose homeostasis, insulin islet secretion, and pancreatic oxidative state in streptozotocin (STZ) diabetic rats. PRP increased pancreatic islet insulin production, pancreatic oxidative stress, and plasma insulin and glucose levels in diabetic rats, the data indicated. Plasma glucose and MDA levels were considerably lowered after PRP therapy, while plasma insulin,

Table 1: Inclusion criteria

Criteria	Inclusion
Time	The publication date for the last 5 years, starting from 2017 to 2021
Type article	International
Theme of article	Effect of PRP on DM or Glucose level

Table 2: Exclusion criteria

Criteria	Exclusion
Type of article	The research method is not descriptive because researchers need to identify the PRP effect, not just a description.
Result	Research results that have been published must have a p-value or must be read by statistics because researchers need to see whether or not there is a relationship effect of PRP on DM.

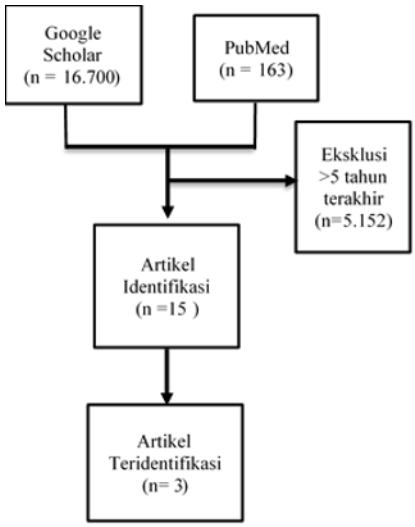

Figure 1: Journal search flow

antioxidant enzyme activity, and insulin islet secretion were raised.

Nemati et al. [17] conducted research on the influence of platelet-rich plasma on islet survival, function, transplantation outcome, and pancreatic gene expression in diabetic rats. In vitro: isolated pancreatic islets were cultured with or without PRP and viability, insulin secretion, and content were determined. In vivo: Series 1 was meant to assess if islet therapy with PRP improves transplantation outcomes in diabetic mice by monitoring plasma glucose, insulin, and oxidative parameters. The results of this investigation indicated a beneficial effect on blood glucose control.

El-Tahawy (2017) [14] did research on the Effect of PRP Injection on the Endocrine Pancreas in Experimentally Induced Diabetes in Albino Male Rats. The study's findings indicated that the diabetes group had a significantly higher blood glucose level than the control group. When compared to the diabetic group, PRP treatment significantly decreased blood glucose levels.

PRP is an autogenous source of cost-effective growth factors that are now used in tissue healing [9]. In pancreatic disorders, microcirculation is disrupted and oxidative stress is produced, resulting in congestion, red blood cell extravasation, and the discharge of tissue fluid. These modifications result in an expansion of the interlobular gaps, which is accompanied by an influx of inflammatory cells [18]. Along with severe islet destruction, this was noted in the diabetic group. Streptozotocin (STZ) is a chemical that, by killing cells, can cause hyperglycemia [19]. In terms of cell regeneration, this article discusses the effect of PRP injection on the regeneration and restoration of pancreatic islet cell mass, as well as the several methods through which PRP enhances the detrimental effects of diabetes. In postnatal mouse research, new islet cells can emerge from progenitors via a process called neo-

genesis [20]. In vivo, GF is utilised to promote pancreatic cell growth. Several of these substances, including VEGF and connective tissue growth factor, have been explored as possible diabetic therapeutics. Peut stimuler la prolifération des cellules et la generation d'insuline [21]. The GF in PRP stimulates the proliferation of these cells, resulting in an increase in cell number.

PRP can regenerate cells in adult mice by stimulating diverse sources of progenitor cells via proliferation and transdifferentiation mechanisms. PRP promotes islet cell regeneration and the induction of other cell types found in the exocrine pancreas, including ductal cells and acinar cells. Additionally, PRP may mimic postnatal growth by placing the pancreas in an environment conducive to the formation of new lobules. This paves the way for innovative diabetic treatments in the future.

CONCLUSION

According to the problem's context and the goal of the literature review, it can be concluded that there is a correlation between the effects of PRP on blood sugar levels in experimental animal models of diabetes.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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