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# The therapeutic effect of camel mesenchymal stem cells on experimentally induced diabetes in rats.

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## Abstract

This study was carried out to investigate the possible therapeutic effect of camel Wharton jelly mesenchymal stem cells (WJ-MSCs) on induced diabetes in rats and compare it with the therapeutic effect of rat bone marrow mesenchymal stem cells ( BM-MSCs) on diabetic rats. The MSCs were successfully isolated from camel Wharton's jelly and rat bone marrow. Induction of diabetes in rats was initiated by streptozotocin (STZ 60 mg/kg). Labeled MSCs with pkh26 stain were injected intravenously by dose of ($3 \times 10^6$ cells) in the diabetic rats. Blood glucose and insulin levels were measured every two weeks as indicator for diabetes. Tissue samples from pancreas, liver and kidneys were collected for histopathological studies. Detection of insulin1, Smad-2 and PDX-1 genes in pancreatic tissues was done by quantitative RT-PCR. Serum was collected for liver and kidney function tests. The insulin level showed significant increase in

diabetic group treated with camel WJ-MSCs at 4 weeks post treatment (P.T) and reach near normal values at the end of experiment. But insulin level in diabetic group treated with rat BM-MSCs began to increase at 6 weeks (P.T) and still exhibit less values than control and camel WJ-MSCs groups at the end of experiment .The results of quantitative RT-PCR revealed significant increased in the three genes in Camel WJ-MSCs group but the Smad-2 gene in rat BM-MSCs group showed decreased values than in control and camel WJ-MSCs group. The histopathological results denote that the diabetic group treated with camel WJMSCs retains the cellular integrity of islets of Langerhans and pancreatic acini. Improvement of STZ side effects in the liver and kidneys was recorded supported by decrease of ALT, AST and Urea levels than diabetic group. In conclusion, camel WJ-MSCs possessed a good therapeutic effect against induced diabetes in rats than rat BM-MSCs. They reduced the side effects of STZ on the liver and kidneys. Their effects were more rapid than rat BM-MSCs.

**Key words**: Camel WJ-MSCs – rat BM-MSCs – STZ - diabetes.

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# *List of abbreviations*

| | |
|---|---|
| ALT | Alanine aminotransferase |
| AST | Aspartate aminotransferase |
| BM-MNCs | Bone marrow mononuclear cell fraction |
| BM-MSCs | Bone marrow Mesenchymal stem cells |
| CD | Cluster differentiation |
| D | Diabetic |
| D+B | Diabetic+ Bone marrow MSCs |
| D+W | Diabetic+ Wharton's Jelly MSCs |
| DM | Diabetes mellitus |
| DMEM | Dulbecco's modified Eagle's medium |
| ESCs | Embryonic stem cells |
| FBS | Fetal bovine serum |
| IDDM | Insulin dependent diabetes mellitus |
| IDF | International Diabetes Federation's |
| IPCs | Insulin-producing cells |
| IPSCs | Induced pluripotent stem cells |
| MHC | Major histocompatibility complex |
| MSCs | Mesenchymal stem cells |
| NIDDM | Non-insulin dependent diabetes mellitus |
| NO | Nitric oxide |
| OH | Hydrogen peroxide |
| P.I | Post induction |
| P.T | Post treatment |
| qRT-PCR | quantitative Real-time polymerase chain reaction |
| STZ | Streptozotocin |
| T h | T helper cells |
| T1DM | Type 1 diabetes mellitus |
| T2DM | Type 2 diabetes mellitus |
| TGF | Transforming growth factor |
| UC-PSCs | Umbilical cord primitive stromal cells |
| WJ-MSCs | Wharton's Jelly Mesenchymal stem cells |
| β-cells | Beta cells |