

关于国家自然科学基金资助项目批准及有关事项的通知

钟文 先生/女士：

根据《国家自然科学基金条例》的规定和专家评审意见，国家自然科学基金委员会（以下简称自然科学基金委）决定批准资助您的申请项目。项目批准号：

81804157，项目名称：基于“脾主肌肉”理论研究益气健脾活血法调控mTOR信号通路干预衰老糖尿病大鼠肌量减损的分子机制，直接费用：21.00万元，项目起止年月：2019年01月至2021年12月，有关项目的评审意见及修改意见附后。

请尽早登录科学基金网络信息系统（<https://isisn.nsfc.gov.cn>），获取《国家自然科学基金资助项目计划书》（以下简称计划书）并按要求填写。对于有修改意见的项目，请按修改意见及时调整计划书相关内容；如对修改意见有异议，须在计划书电子版报送截止日期前提出。

计划书电子版通过科学基金网络信息系统（<https://isisn.nsfc.gov.cn>）上传，由依托单位审核后提交至自然科学基金委进行审核。审核未通过者，返回修改后再行提交；审核通过者，打印为计划书纸质版（一式两份，双面打印），由依托单位审核并加盖单位公章后报送至自然科学基金委项目材料接收工作组。计划书电子版和纸质版内容应当保证一致。向自然科学基金委提交和报送计划书截止时间节点如下：

- 1、提交计划书电子版截止时间为**2018年9月11日16点**（视为计划书正式提交时间）；
- 2、提交计划书电子修改版截止时间为**2018年9月18日16点**；
- 3、报送计划书纸质版截止时间为**2018年9月26日16点**。

请按照以上规定及时提交计划书电子版，并报送计划书纸质版，未说明理由且逾期不报计划书者，视为自动放弃接受资助。

附件：项目评审意见及修改意见表

国家自然科学基金委员会
医学科学部
2018年8月16日

附件：项目评审意见及修改意见表

项目批准号	81804157	项目负责人	钟文	申请代码1	H2716
项目名称	基于“脾主肌肉”理论研究益气健脾活血法调控mTOR信号通路干预衰老糖尿病大鼠肌量减损的分子机制				
资助类别	青年科学基金项目	亚类说明			
附注说明					
依托单位	成都中医药大学				
直接费用	21.00 万元	起止年月	2019年01月 至 2021年12月		
通讯评审意见： <1> 一、简述申请项目的主要研究内容和申请者提出的科学问题或假说 中医理论认为脾主肌肉，脾胃为后天之本。临床对于肌肉相关问题处理中医多从脾胃入手。肌肉萎缩从脾入手符合中医基本理论。申请者的前期工作发现，益气活血方参芪复方有助于保持肌量，可致雷帕霉素信号通路差异基因表达，从而建立假说：益气健脾活血法保持肌量的作用与调控mTOR信号通路、影响相关蛋白质代谢有关。糖尿病作为主代表性的代谢性疾病，肌肉萎缩发生常见。本项目以糖尿病肌萎缩为研究对象来展开研究，选择合理。 二、具体意见 （一） 申请项目的预期结果及其科学价值和意义 预期结果紧密结合了假说，能有效地支持中医脾主肌肉的理论，对临床有针对性地从脾入手干预糖尿病等导致肌少症的疾病，具有一定的指导意义。 （二） 科学问题或假说是否明确，是否具有创新性 申请人者基于中医基本理论及前期的实验结果提出假说，有充分的理论依据和一定的实验基础。假说既符合常识，也具有创新。 （三） 研究内容、研究方案及所采用的技术路线 研究内容基本合理。但一些研究内容应当是前期基础中应该完成的。技术路线清楚，符合逻辑。具有可行性。 （四） 申请人的研究能力和研究条件 申请人研究能力尚可，具有完成本项目的技术贮备。依托单位具有实验本研究的条件。 （五） 其它意见或修改建议 如果有临床基础更好。 <2> 一、简述申请项目的主要研究内容和申请者提出的科学问题或假说 本研究提出“益气健脾活血法保持肌量的作用可能与调控mTOR信号通路、影响蛋白质代谢有关”的问题，拟以蛋白质代谢为入口，运用mTOR信号通路磷酸化抗体芯片、蛋白免疫印迹等技术，阐释益气健脾活血法调控mTOR信号通路、影响蛋白质代谢、干预衰老糖尿病大鼠肌量减损的分子机制。 二、具体意见 （一） 申请项目的预期结果及其科学价值和意义 预期将基于“脾主肌肉”理论阐明益气健脾活血法调控mTOR信号通路干预衰老糖尿病大鼠肌量减损的分子机制。 （二） 科学问题或假说是否明确，是否具有创新性 假说明确，创新性可。					

(三) 研究内容、研究方案及所采用的技术路线
研究方案可行。

(四) 申请人的研究能力和研究条件
申请人具备较好的研究能力，研究条件具备。

(五) 其它意见或修改建议

<3>

一、简述申请项目的主要研究内容和申请者提出的科学问题或假说

主要研究内容：本研究拟以蛋白质代谢为入口，运用mTOR信号通路磷酸化抗体芯片、蛋白免疫印记等技术，阐释益气健脾活血法调控mTOR信号通路、影响蛋白质代谢、干预衰老糖尿病大鼠肌量减损的分子机制。

提出的科学假说：益气健脾活血法指导下的参芪复方通过介导mTOR信号网络调控蛋白质代谢，防止肌量丢失，干预老年糖尿病相关性肌减少。

二、具体意见

(一) 申请项目的预期结果及其科学价值和意义

本项目试图阐明益气健脾活血法缓解糖尿病性肌量减损、防治老年糖尿病性肌少症的作用；探索益气健脾活血法介导mTOR信号网络调控骨骼肌蛋白质代谢的分子机制，剖析该法用于治疗老年糖尿病性肌少症的微观作用机制。糖尿病是临床常见病多发病，肌少症也为老年人群常见病多发病，两者互相影响，本项目具有一定的科学价值和意义。

(二) 科学问题或假说是否明确，是否具有创新性

该项目基于“益气健脾活血法指导下的参芪复方通过介导mTOR信号网络调控蛋白质代谢，防止肌量丢失，干预老年糖尿病相关性肌减少”，假说明确，本项目拟从mTOR信号网络调控蛋白质代谢角度探讨益气健脾活血法干预衰老糖尿病大鼠肌量减损的分子机制，阐释益气健脾活血法防治糖尿病相关性肌少症的生物学机制，为益气健脾活血法的临床应用提供科学依据，有一定创新性。

(三) 研究内容、研究方案及所采用的技术路线

本项目以蛋白质代谢为入口，运用mTOR信号通路磷酸化抗体芯片、蛋白免疫印记等技术，阐释益气健脾活血法调控mTOR信号通路、影响蛋白质代谢、干预衰老糖尿病大鼠肌量减损的分子机制。研究内容及研究方案基本合理，研究方案基本符合逻辑，技术路线可行，基本可以验证项目假说。

(四) 申请人的研究能力和研究条件

申请人文字表达能力较好，思路清楚。具有较好的研究能力及研究实验基础。

(五) 其它意见或修改建议

修改意见：

医学科学部

2018年8月16日

Approval Notification for National Natural Science Foundation Grant (Youth Fund)

In accordance with the regulations of the "National Natural Science Foundation Ordinance" and expert review opinions, the NSFC has approved funding for your project application.

Project Details:

Project Approval Number: 81804157

Project Title: Study on the molecular mechanism of "Spleen-Governing Muscle" theory using Qi-invigorating, Spleen-strengthening, and Blood-activating methods to regulate the mTOR signaling pathway to prevent muscle mass reduction in aging diabetic rats.

Direct Costs: 210,000 RMB

Project Duration: January 2019 to December 2021

The review comments and suggested modifications are attached. Please log into the NSFC network information system to obtain and complete the project plan form as required. If there are any requested modifications, please make adjustments to the form accordingly.

Submission Deadlines:

Electronic submission: by September 11, 2018, 4:00 PM.

Modified electronic version (if applicable): by September 18, 2018, 4:00 PM.

Printed submission: by September 26, 2018, 4:00 PM.

Attachment: Review Opinions and Modification Suggestions

The document includes detailed reviewer comments covering the project's research objectives, hypothesis, scientific value, and expected outcomes. It highlights the importance of addressing muscle atrophy related to diabetes from a Traditional Chinese

Medicine perspective, specifically using the "Spleen-Governing Muscle" theory. The reviewers noted that the hypothesis is well-founded, innovative, and the research plan logical and feasible. There are additional technical suggestions, such as enhancing the project with clinical data if possible.

Below is the detailed comments:

Peer Review Comments:

<1>

1. Summary of the main research content and the scientific question or hypothesis proposed by the applicant

According to Traditional Chinese Medicine (TCM) theory, the spleen governs muscles, and the spleen and stomach are considered the foundation of acquired constitution. Clinically, TCM often approaches muscle-related issues by focusing on the spleen and stomach, which aligns with fundamental TCM theory regarding muscle atrophy. Preliminary work by the applicant has shown that the Qi-tonifying and blood-activating formula, Shenqi Compound, aids in preserving muscle mass, possibly leading to differential gene expression in the mTOR signaling pathway. This led to the hypothesis: the Qi-tonifying, spleen-strengthening, and blood-activating method's effect on preserving muscle mass is related to the regulation of the mTOR signaling pathway and associated protein metabolism. Diabetes, as a representative metabolic disease, frequently involves muscle atrophy. The project is therefore appropriately focused on diabetic muscle atrophy.

2. Specific Comments

○ **(a) Expected results, scientific value, and significance of the project**

The expected results align closely with the hypothesis and effectively support the TCM theory that the spleen governs muscles. This approach of focusing on the spleen to address conditions like sarcopenia caused by diabetes has clinical relevance and provides valuable guidance.

○ **(b) Is the scientific question or hypothesis clear and innovative?**

The applicant's hypothesis, based on TCM theory and preliminary experimental results, has a strong theoretical foundation and

experimental basis. The hypothesis is both reasonable and innovative.

- **(c) Research content, research plan, and technical approach**

The research content is generally reasonable, though some aspects should be addressed in preliminary foundational work. The technical approach is clear, logical, and feasible.

- **(d) Applicant's research ability and research conditions**

The applicant has adequate research capabilities and technical resources to complete the project. The supporting institution has the necessary experimental conditions for this research.

- **(e) Other comments or suggestions for modification**

A clinical foundation would be beneficial if available.

<2>

1. **Summary of the main research content and the scientific question or hypothesis proposed by the applicant**

This research proposes that the Qi-tonifying, spleen-strengthening, and blood-activating method's role in preserving muscle mass may be related to regulating the mTOR signaling pathway and impacting protein metabolism. The study intends to use protein metabolism as the entry point and utilize mTOR pathway phosphorylation antibody arrays and Western blotting techniques to explain how this method regulates the mTOR signaling pathway, affects protein metabolism, and intervenes in muscle mass reduction in aging diabetic rats.

2. **Specific Comments**

- **(a) Expected results, scientific value, and significance of the project**

The study aims to elucidate the molecular mechanism by which the Qi-tonifying, spleen-strengthening, and blood-activating method regulates the mTOR signaling pathway to intervene in muscle mass loss in aging diabetic rats, based on the theory of the spleen governing muscles.

- **(b) Is the scientific question or hypothesis clear and innovative?**

The hypothesis is clear and shows potential for innovation.

- **(c) Research plan and technical approach**

The research plan is feasible.

- **(d) Applicant's research ability and research conditions**

The applicant has strong research ability, and the research conditions are sufficient.

- **(e) Other comments or suggestions for modification**

[No specific additional suggestions were provided.]

<3>

1. **Summary of the main research content and the scientific question or hypothesis proposed by the applicant**

Main research content: This study plans to use protein metabolism as the entry point and employ mTOR signaling pathway phosphorylation antibody arrays and Western blotting techniques to elucidate how the Qi-tonifying, spleen-strengthening, and blood-activating method regulates the mTOR signaling pathway, affects protein metabolism, and intervenes in muscle mass reduction in aging diabetic rats.

Proposed hypothesis: The Shenqi Compound, under the guidance of the Qi-tonifying, spleen-strengthening, and blood-activating method, prevents muscle mass loss by mediating the mTOR signaling network to regulate protein metabolism, thereby intervening in age-related muscle loss in diabetic conditions.

2. **Specific Comments**

- **(a) Expected results, scientific value, and significance of the project**

This project seeks to clarify the role of the Qi-tonifying, spleen-strengthening, and blood-activating method in alleviating diabetes-related muscle loss and preventing sarcopenia in elderly diabetic patients. It aims to explore the molecular mechanism by which this method mediates the mTOR signaling network to regulate skeletal muscle protein metabolism, providing a detailed understanding of this approach for treating sarcopenia in elderly diabetics. Diabetes and sarcopenia are both common conditions, especially in elderly

populations, and they impact each other. This project has significant scientific value and relevance.

- **(b) Is the scientific question or hypothesis clear and innovative?**

Based on the hypothesis that the Shenqi Compound, guided by the Qi-tonifying, spleen-strengthening, and blood-activating method, prevents muscle loss by mediating the mTOR signaling network to regulate protein metabolism, the project seeks to investigate this method's intervention in age-related muscle loss in diabetic rats. It explains the biological mechanism for using this method to prevent diabetes-related sarcopenia, providing scientific evidence for its clinical application, and demonstrates a certain level of innovation.

- **(c) Research content, research plan, and technical approach**

This project uses protein metabolism as the entry point and applies mTOR pathway phosphorylation antibody arrays and Western blotting techniques to elucidate the molecular mechanism by which the Qi-tonifying, spleen-strengthening, and blood-activating method regulates the mTOR signaling pathway, affects protein metabolism, and intervenes in muscle mass reduction in aging diabetic rats. The research content and plan are generally reasonable, logically consistent, and the technical approach is feasible, allowing the hypothesis to be tested.

- **(d) Applicant's research ability and research conditions**

The applicant has good writing skills and a clear thought process, as well as strong research capability and a solid experimental foundation.

- **(e) Other comments or suggestions for modification**

[No specific additional suggestions were provided.]