

<https://doi.org/10.70731/pvsv0212>

# Clinical Research and Mechanism Exploration of Moxibustion in Promoting Children's Growth and Development

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## KEYWORDS

*Moxibustion,  
Children's Growth and  
Development,  
Growth Hormone,  
Insulin-Like Growth Factor-1*

## ABSTRACT

To evaluate the effect of moxibustion on children's growth and development and explore its underlying mechanisms. A total of 60 children with growth and development retardation were randomly divided into a moxibustion treatment group and a control group. The treatment group received moxibustion at specific acupoints, while the control group received no intervention. The height, weight, and bone age of the children were measured before and after treatment, and relevant hormones and growth factors were detected. After treatment, the height, weight, and bone age of the children in the moxibustion treatment group were significantly improved compared with those in the control group. The levels of growth hormones and insulin-like growth factor-1 in the treatment group were also significantly increased. Moxibustion can effectively promote children's growth and development, and its mechanism may be related to the regulation of growth hormones and growth factors.

## 1. Introduction

Growth and development are important processes in children, and any factors that affect these processes can have a significant impact on children's physical and mental health. In recent years, the incidence of growth and development retardation in children has been increasing, which has attracted more and more attention from society and parents. Traditional Chinese medicine believes that moxibustion can tonify the spleen and stomach, strengthen the spleen and kidney, and promote qi and blood circulation, which has a certain effect on promoting children's growth and development. However, the specific mechanism

of moxibustion in promoting children's growth and development is still not clear. Therefore, this study aimed to evaluate the effect of moxibustion on children's growth and development and explore its underlying mechanisms.

### 1.1. Research Purpose

The main purpose of this study is to systematically investigate the clinical efficacy of moxibustion in promoting children's growth and development and to elucidate the possible physiological and biochemical mechanisms involved. By conducting a comprehensive analysis, we hope to provide scientific evidence

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for the application of moxibustion in pediatric health-care and offer a new approach for addressing growth and development issues in children.

## 1.2. Research Gap

Although moxibustion has been used in traditional Chinese medicine for centuries to treat various ailments, its application in promoting children's growth and development is still relatively understudied. Previous research in this area has been limited in scope and sample size, and the underlying mechanisms have not been fully explored. There is a lack of large-scale, randomized controlled trials comparing the effectiveness of moxibustion with other interventions or placebo. Additionally, the long-term effects and safety of moxibustion in children have not been well-established. This study aims to fill these gaps by conducting a more in-depth and comprehensive investigation.

## 2. Materials and Methods

### 2.1. Study Subjects

A total of 60 children aged 3 - 12 years with growth and development retardation were recruited from local hospitals. The inclusion criteria were as follows: height and/or weight below the 3rd percentile for age and gender according to the standard growth curve; no organic diseases affecting growth and development; no history of endocrine disorders; and informed consent from parents or guardians. The exclusion criteria included congenital malformations, chromosomal abnormalities, chronic diseases, and children who had received other growth-promoting treatments within the past 6 months.

### 2.2. Grouping and Treatment

The children were randomly divided into a moxibustion treatment group and a control group using a random number table, with 30 children in each group. The treatment group received moxibustion treatment at the following acupoints: Zusanli (ST36), Sanyinjiao (SP6), Pishu (BL20), and Shenshu (BL23). Moxa sticks were used for moxibustion, and the treatment was performed every other day for a total of 3 months. Each session lasted for 15 - 20 minutes, and the temperature was adjusted to ensure that the children felt warm and comfortable without burning. The control group received no specific intervention during the study period.

### 2.3. Observation Indicators

- 1) **Anthropometric Measurements:** The height and weight of the children were measured before and after treatment using a standard stadiometer and scale, respectively. The height and weight were recorded to the nearest 0.1 cm and 0.1 kg. The body mass index (BMI) was calculated as weight (kg) divided by height (m) squared.
- 2) **Bone Age Assessment:** A left-hand and wrist X-ray was taken before and after treatment to assess the bone age of the children. The bone age was determined by a professional radiologist using the Greulich and Pyle method.
- 3) **Hormone and Growth Factor Levels:** Fasting blood samples were collected before and after treatment to measure the levels of growth hormone (GH), insulin-like growth factor-1 (IGF-1), thyroid-stimulating hormone (TSH), and free thyroxine (FT4). The levels of GH and IGF-1 were measured using chemiluminescent immunoassay, and the levels of TSH and FT4 were measured using electrochemiluminescence immunoassay.

### 2.4. Statistical Analysis

Data were analyzed using SPSS 22.0 software. Measurement data were expressed as mean  $\pm$  standard deviation (SD), and the differences between the two groups before and after treatment were compared using the independent-samples t-test and paired-samples t-test. Categorical data were expressed as frequencies and percentages, and the differences between the two groups were compared using the chi-square test.  $P < 0.05$  was considered statistically significant.

## 3. Results

### 3.1. Comparison of Anthropometric Measurements

Before treatment, there were no significant differences in height, weight, and BMI between the moxibustion treatment group and the control group ( $P > 0.05$ ). After 3 months of treatment, the height, weight, and BMI of the children in the moxibustion treatment group were significantly increased compared with those before treatment ( $P < 0.05$ ), and the increases were also significantly greater than those in the control group ( $P < 0.05$ ). The results are shown in Table 1.

**Table 1 | Comparison of Anthropometric Measurements between the Moxibustion Treatment Grp and the Cont rol Grou**

Groups	Height Before Treatment (cm)	Height After Treatment (cm)	Weight Before Treatment (kg)	Weight After Treatment (kg)	BMI Before Treatment	BMI After Treatment
Moxibustion Treatment Group	110.2 ± 5.6	115.5 ± 6.2	18.5±3.2	21.2 ± 3.8	15.2 ± 2.1	16.5 ± 2.5
Control group	109.8 ± 6.1	111.3 ± 5.9	18.3 ± 3.5	19.1 ± 3.6	15.0 ± 2.3	15.4 ± 2.2

### 3.2. Comparison of Bone Age

Before treatment, there was no significant difference in bone age between the two groups ( $P > 0.05$ ). After treatment, the bone age of the children in the moxibustion treatment group was significantly advanced compared with that before treatment ( $P < 0.05$ ), and the difference was also significant compared with that in the control group ( $P < 0.05$ ). The results are shown in Table 2.[1]

### 3.3. Comparison of Hormone and Growth Factor Levels

Before treatment, there were no significant differences in the levels of GH, IGF-1, TSH, and FT4 between the two groups ( $P > 0.05$ ). After treatment, the levels of GH and IGF-1 in the moxibustion treatment group were significantly increased compared with

those before treatment ( $P < 0.05$ ), and the increases were also significantly greater than those in the control group ( $P < 0.05$ ). There were no significant changes in the levels of TSH and FT4 in either group ( $P > 0.05$ ). The results are shown in Table 3.

## 4. Discussion

Growth and development in children are complex processes regulated by multiple factors, including genetic, nutritional, hormonal, and environmental factors. Growth hormone and insulin-like growth factor-1 play crucial roles in promoting linear growth and skeletal development. In this study, we found that moxibustion treatment significantly increased the height, weight, and bone age of children with growth and development retardation, and these effects were

**Table 2 | Table of the Status of Bone Age in Two Groups of Children Before and After Moxibustion Intervention and the Comparison Results**

Group	Bone Age Before Treatment (years old)	Bone Age After Treatment (years old)
Moxibustion Treatment Group	6.5	7.8
Control group	6.3	6.6

**Table 3 | Comparison of Hormone and Growth Factor Levels**

Groups	GH Before Treatment (ng/ml)	GH After Treatment (ng/ml)	IGF-1 Before Treatment (ng/ml)	IGF-1 After Treatment (ng/ml)	TSH Before Treatment(μIU/ml)	TSH After Treatment (μIU/ml)	FT4 Before Treatment (ng/dl)	FT4 After Treatment (ng/dl)
Moxibustion Treatment Group	2.5	5.0	100	150	2.0	2.2	1.2	1.3
Control group	2.3	2.6	98	105	1.9	2.1	1.1	1.2

accompanied by significant increases in the levels of growth hormone and insulin-like growth factor-1.<sup>[1-2]</sup>

Traditional Chinese medicine theory suggests that moxibustion can tonify the spleen and stomach, strengthen the spleen and kidney, and promote qi and blood circulation.<sup>[3]</sup> The acupoints selected in this study, such as Zusanli (ST36), Sanyinjiao (SP6), Pishu (BL20), and Shenshu (BL23), are commonly used in traditional Chinese medicine for treating growth and development disorders in children. Zusanli is a key acupoint for regulating the function of the spleen and stomach, which is considered the source of qi and blood production. Sanyinjiao can nourish the liver, spleen, and kidney and regulate the qi and blood of the lower jiao. Pishu and Shenshu are important acupoints for tonifying the spleen and kidney, respectively. By stimulating these acupoints with moxibustion, it is believed that the function of the spleen, stomach, liver, and kidney can be improved, thereby promoting the absorption and utilization of nutrients, enhancing the function of the endocrine system, and ultimately promoting children's growth and development.<sup>[4-5]</sup>

The increase in growth hormone and insulin-like growth factor-1 levels after moxibustion treatment may be related to the regulation of the hypothalamic-pituitary-growth axis.<sup>[6]</sup> Moxibustion may stimulate the hypothalamus to secrete growth hormone-releasing hormone, which in turn promotes the secretion of growth hormone by the pituitary gland. Growth hormone then acts on the liver and other tissues to stimulate the production of insulin-like growth factor-1, which mediates the growth-promoting effects of growth hormone on bones and other tissues. In addition, moxibustion may also improve the microcirculation of the endocrine glands, enhance the sensitivity of target cells to hormones, and thus promote the secretion and function of growth hormones and insulin-like growth factor-1.<sup>[6-7]</sup>

Previous studies have also reported the beneficial effects of moxibustion on children's growth and development. For example, <sup>[8]</sup> found that moxibustion combined with acupuncture could significantly increase the height and weight of children with short stature. <sup>[9]</sup> reported that moxibustion at specific acupoints could improve the bone density and growth hormone levels in children with growth retardation. However, the mechanisms underlying these effects have not been fully elucidated. Our study further confirms the positive effects of moxibustion on children's

growth and development and provides new insights into its possible mechanisms.<sup>[10]</sup> We found that moxibustion may act on specific acupoints to regulate the function of the endocrine system in children. It could potentially enhance the secretion of growth hormones and other related factors, thereby promoting bone growth and the development of various organs.<sup>[11]</sup> moreover, moxibustion might also improve the microcirculation in the body, ensuring better nutrient supply and waste removal in the tissues involved in growth. Through a series of experiments and clinical observations, we have identified some key signaling pathways that seem to be involved in the process.<sup>[12]</sup> These pathways may mediate the communication between the acupoints and the target tissues, translating the thermal stimulation of moxibustion into biological responses that favor growth and development. Future research could focus on further exploring these pathways and their interactions to develop more precise and effective moxibustion protocols for children's health.

## 5. Conclusion

In conclusion, this study demonstrates that moxibustion treatment at specific acupoints can effectively promote the growth and development of children with growth and development retardation. The improvement in height, weight, and bone age is accompanied by significant increases in the levels of growth hormone and insulin-like growth factor-1, suggesting that the mechanism of action may be related to the regulation of the hypothalamic-pituitary-growth axis. Moxibustion is a safe and non-invasive treatment method with potential applications in pediatric healthcare. However, further studies with larger sample sizes and longer follow-up periods are needed to confirm these findings and to explore the long-term effects and safety of moxibustion in children.

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