



## Review article

# Taijiao: a traditional Chinese approach to enhancing fetal growth through maternal physical and mental health

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## ABSTRACT

Despite the fact that *Taijiao* (traditional Chinese eugenics) has been part of the Chinese obstetrical culture over the years, there is insufficient scientific evidence for its effectiveness. This literature review analyzes the discourse on *Taijiao* associated with physical and psychological maternal–fetal symbiosis, together with relevant peripheral research outcomes. *Taijiao* combines maternal health and external environment for benefits in fetal growth through preventive, indirect, and direct measures. Discussing practical implications and future research directions, this review reveals a modernized *Taijiao* to be a holistic, non-invasive pregnancy management system using a multi-disciplinary approach that enhances infantile life quality, reduces negative consequences of pregnancy deficits and child development, and saves public health expenditure.

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## 1. Introduction

*Taijiao*, as ancient Chinese eugenics is articulated in philosophical, medical, literature, and historical texts, has been widely adopted among pregnant women in China. It commenced more than 3600 years ago and has been part of China's obstetrical culture since the Han Dynasty.<sup>1</sup> *Taijiao* acknowledges the significance of maternal physical and psychological health as well as the external environment, in affecting not only fetal growth<sup>2</sup> but also infant development. It combines Chinese medical theories and clinical experience,<sup>3</sup> even applying Western medicinal concepts to *Taijiao* from the early 20th century,<sup>4</sup> in order to promote maternal and neonatal health. Thus, academia has increased its interest in *Taijiao*, despite a scarcity of empirical studies.<sup>5</sup> This literature review analyses the present discourse related to such conventional wisdom, which has been agreed upon in updated, relevant peripheral research studies. Initially, the review describes the concept and practices of *Taijiao*, while subsequently assessing its underpinnings in scholarly projects, which brings out practical implications and future inter-disciplinary research for modernizing the use of *Taijiao* that contributes to the health of the citizenry over their whole lifetime.

Commonly translated as “fetal education”,<sup>6,7</sup> *tai* refers to *fetus* and *jiao* to *teach*. In addition, various other renditions also exist; for example, *antenatal training*,<sup>8</sup> *prenatal training*,<sup>9</sup> *prenatal education*,<sup>10</sup> *prenatal influence*,<sup>11</sup> and *fetal or prenatal instructions*.<sup>12</sup> However, *Taijiao* dissociates embryos from education or training in the womb, even though fetal associative learning,<sup>13–16</sup> fetal language learning,<sup>17</sup> and short-term memory after 30 weeks<sup>18</sup> may be feasible. The term *Taijiao* is used throughout this review to reflect this idea more accurately, being closely connected to fetal protection and development by means of maternal health promotion,<sup>19</sup> thereby illustrating a maternal-fetal synchrony.<sup>20</sup>

*Taijiao* is a series of purposive preparations during gestation that exert direct or indirect influences on physical and psychological aspects of pregnant women for the sake of positive fetal development regarding physiological and mental health:<sup>21,22</sup> *Taijiao* inception is recommended as early as the second month of pregnancy.<sup>23</sup> Its benefits comprise better embryonic growth of sensory, neurological, and physical functions, along with infantile development in language learning and psychological well-being,<sup>24</sup> thus indicating an extended impact on progression from the fetus and adolescent stages to the whole life span.

## 2. Maternal-fetal symbiosis

Chinese literature details *Taijiao* methods that can be distributed among various domains: preventive, indirect, and direct methods.

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## 2.1. Preventive methods

Liu,<sup>25</sup> a renowned scholar in the Han Dynasty, emphasized preventive measures, including the avoidance of graceless sleeping, sitting and standing postures, of noxious and toxic foods, and of unpleasant scenes, and unlovely sounds. Research supports his propositions, cautioning that inappropriate sitting and standing postures can possibly result in low birth weight,<sup>26</sup> and improper sleeping positions may potentially lead to stillbirth.<sup>27,28</sup>

Furthermore, sleeping quality affects maternal and fetal outcomes; however, sleeping problems are common,<sup>29</sup> particularly in late pregnancy,<sup>30</sup> because of hormonal and psychological changes.<sup>31</sup> Sleeping disorders and short sleep duration may induce pre-term deliveries<sup>32</sup> and a greater latency in post-partum depression.<sup>33</sup>

Harmful substances primarily degrade health in pregnancy especially liquor, narcotics, and nicotine. Prenatal alcohol consumption evokes alcohol-related neuro-developmental disorders, developmental delays, and central nervous system dysfunction. Alcohol-affected neonates will suffer from behavioral, learning, and mental disabilities, hurting their self-regulation and adaptive skills.<sup>34</sup> Similarly, the data elucidate a correlation between prenatal substance abuse and lower birth weight, resulting in higher risks related to childhood psychotic problems.<sup>35</sup> Probing substantial evidence, scholars warn of the effects of cigarettes smoking in pregnancy, covering sudden infant death syndrome, placental disruption, perinatal mortality, fetal growth restriction, lower birth weight, child behavioral deficits, neuro-cognitive decrements, intelligence reduction, chronic pulmonary diseases, and childhood cancer.<sup>36–45</sup> Even maternal passive smoking shows positive correlation with pre-term birth,<sup>46,47</sup> asthma in childhood,<sup>48</sup> and child behavioral problems.<sup>49</sup> These may further associated with ongoing difficulties in adolescence as well.<sup>50–52</sup>

Environmental noises deteriorate sleep quality and therefore affect the endocrine system, being adversely associated with anxiety.<sup>53,54</sup> Apart from the inimical consequences of poor sleep, as accounted for earlier, noise-generated stress<sup>55,56</sup> can cause miscarriage, prematurity and intrauterine retardation, and noise-induced hearing loss in newborns.<sup>57</sup> Noise exposure during pregnancy should be obviated.

## 2.2. Indirect methods

Indirect *Taijiao*<sup>58</sup> refers to fetal growth affected by maternal conditions and external factors, including emotions, diet and nutrition, exercise, climate, and living environment. Folk practices also apply in choosing good names for babies, and looking at beautiful baby photographs,<sup>59</sup> which nurture psychological satisfaction in pregnant women.

Evidence-based research shows gestational psychological state to be a determinant of mental maternal–fetal association<sup>60</sup>; therefore, emotional training is an essential component in maternal programs.<sup>61</sup> Negative emotions, such as anger and panic, not only devastate the maternal mental state but also impact fetal development.<sup>62,63</sup> Women who are depressed in maternity produce a chemically imbalanced prenatal environment that impacts embryonic growth,<sup>64,65</sup> including its physiology and behavior,<sup>66</sup> and childhood mental health.<sup>67,68</sup> Akin to depression, maternal stress and anxiety damage fetal neurodevelopment,<sup>69</sup> and engender lifetime detrimental effects on the brain,<sup>70</sup> potentially resulting in offspring schizophrenia.<sup>71</sup>

Balanced nutrients build health and strong bodily functions; poor nutrition in pregnant women results in a higher incidence of growth retarded newborns.<sup>72</sup> In addition to healthy diets, vitamin D supplementation is proposed during pregnancy and early

childhood, which is likely to reduce autism.<sup>73</sup> Taking balanced energy, protein, and mineral supplementation is also suggested because this decreases stillbirth and neonatal mortality,<sup>74</sup> and enhances infant health.<sup>75</sup> In contrast, over-nutrition and maternal obesity impair fetal growth,<sup>76</sup> possibly yielding attention-deficit hyperactivity disorder symptoms and behaviors among offspring.<sup>77</sup>

Together with diet and nutrition, maternal activities contribute to embryonic development<sup>78</sup> and minimize the risk of a mother being overweight. Regular safe physical exercises are positively indicated for fetal growth<sup>79</sup> and favorable long-term health effects.<sup>80</sup> They also reduce the risk of inadequate birth weight,<sup>81</sup> achieve better maternal and fetal emotional states,<sup>82,83</sup> shorten labor and hospital stays,<sup>84</sup> and decrease pregnancy-related lumbopelvic pain.<sup>85</sup> Recently, guided yoga programs for pregnant women have become prevalent, which is conducive to utero-fetal-placental circulation<sup>86</sup> and improvements in labor and birth outcomes.<sup>87</sup> Prenatal meditation is effective for pregnant women in dealing with pregnancy challenges and improving emotional wellness and social relationships.<sup>88</sup>

Unfavorable environmental factors hinder maternal and embryonic health.<sup>89</sup> Long exposure to a polluted indoor environment can incur spontaneous abortion or premature birth.<sup>90</sup> Chemicals such as pesticides restrict fetal growth in weight, length, and head circumference.<sup>91</sup> Moreover, adverse outcomes in climate change hamper the health of pregnant women, fetuses, and newborns.<sup>92</sup>

## 2.3. Direct methods

Direct *Taijiao* refers to sensory stimulation (not limited to sound, light, and vibration) provided to pregnant women in order to yield advantageous fetal outcomes, including music *Taijiao*, dialogue *Taijiao*, massage *Taijiao*, touching *Taijiao*, and light *Taijiao*,<sup>93</sup> among which music *Taijiao* is the most popular.

The auditory-motor system is nearly developed around the 16th week of pregnancy,<sup>94</sup> and physiological and behavioral responses to musical rhythm are observable.<sup>95</sup> The findings of a project conducted with 31 participants in the experiment group and 29 in the control group<sup>96</sup> demonstrated that infants who received music *Taijiao* were able to recognize the *Taijiao* music, reflecting infantile listening memory. Music *Taijiao* consists of popular music,<sup>97</sup> music appreciation, singing, and the use of musical devices.<sup>98</sup> In one study, 260 pregnant women listened to 15 minutes of soft music throughout a four-dimensional ultrasound, while at the same time touching the abdomen.<sup>10</sup> Results included decreases in umbilical artery resistance index and systolic-diastolic ratios, denoting an increase in umbilical cord blood flow in placental perfusion with a reduction in resistance, growth of fetal aortic flow velocity and cardiac output; but a reduction in resistance index and systolic-diastolic ratios in the fetal middle cerebral artery. These reflect positive effects on fetal development due to improved blood circulation, cardiac output, and blood supply to the brain. Similarly, a randomized controlled trial with 126 participants in the intervention group and 134 in the control group assessed how antenatal music exposure affects neonatal behavior.<sup>99</sup> Women in the 20th week of pregnancy in the intervention group listened to the pre-recorded music 50 minutes every day. Outcomes reported better regulations in behavioral states and autonomic stability of the participants, and better motor performance in their newborns. These suggest the future invention of marketable products<sup>100</sup>; for instance, *Taijiao* music trousers for pregnant women.<sup>101</sup>

Touching and dialogue *Taijiao* are likely beneficial to fetuses. An intervention group with 1350 participants (using these two methods) reported shorter checking duration for fetal heart rate and less unidentified checking results through an electronic

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