

The Relationship between Physical Exercise and Sense of Coherence among Rural Left-behind Children of China

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Abstract: Sense of coherence (SOC) plays an important role in maintaining individual mental health. However, the impact of physical exercise on the SOC of rural left-behind children remains unclear. This study intends to address the status of physical exercise and SOC in rural left-behind children and analyze the relationship between the two. A random cluster sampling method was employed to investigate 804 students from grades 3-9 in Hunan Province, utilizing a physical activity rating scale and a sense of coherence scale. 18.9% of the rural left-behind children engaged in high activity. Boys scored higher than girls in terms of exercise intensity, duration, frequency, and total physical exercise score ($P < 0.01$). The SOC score of rural left-behind children was 34.65 ± 14.91 , with boys scoring higher than girls ($P = 0.001$). A positive correlation existed between physical exercise and the total score and three dimensions of SOC ($P < 0.01$). Physical exercise is an effective way to enhance SOC among rural left-behind children. This finding provides a new approach for improving the SOC of left-behind children.

Keywords: Left-Behind Children; Physical Exercise; Mental Health; Sense of Coherence

1. Introduction

During the urbanization in China, a significant number of rural laborers migrate to cities for work, leaving their children behind in rural areas, thus forming a special group known as rural left-behind children [1]. The Chinese government defines left-behind children as those under the age of 16 who are left in the care of elders or others due to one or both parents working away from home for extended periods [2]. In 2022, the number of rural left-behind children in China reached 9.02 million, with 360,000 being unattended [3]. Due to the prolonged absence of parents, left-behind children experience more

psychological conflicts and stress than other rural children, making them more susceptible to developmental issues during their growth. Their physical and mental well-being has garnered significant social attention. Studies have shown that rural left-behind children exhibit much higher rates of psychological symptoms, such as depression and anxiety, than non-left-behind children [4,5]. They are also more likely to engage in undesirable behaviors such as truancy, fighting, stealing, and robbery [2,3,6]. These challenges relate closely to their SOC [7].

Sense of coherence (SOC) is a key concept in the salutogenic model [8,9]. It refers to an individual's overall cognitive tendency towards life, encompassing their response to internal and external stress, their resources for coping with stress, as well as their perception of the meaning of life, expressing a deep, enduring, and motivational self-confidence possessed by the individual [10]. Extensive studies have shown that individuals with higher SOC tend to experience lower levels of anxiety, depression and life stress, with better physical and mental health than those with lower SOC [11]. In other words, SOC serves as a buffer and coordinator between objective stressful life events and an individual's external psychological and physiological manifestations. SOC was acquired over time and shaped in early childhood, with adversity and pressure experienced in childhood and adolescence contributing to its development [10,12]. Childhood and adolescence were important stages for SOC development. Taken together, for the special group of rural left-behind children, who face urgent psychological health issues, it is crucial to help them develop SOC during their growth. However, studies on the SOC of left-behind children are scarce.

Physical exercise has been shown to significantly influence an individual's mental health level [13], but few studies are available on its relationship with SOC. da-Silva-Domingues et al. concluded from their analysis that there was a significant positive correlation

between SOC and adolescents' health behaviors (including physical activity) [14]. A study involving secondary school students showed a positive correlation between moderate to high levels of physical exercise and SOC, with better exercise promoting SOC development [15]. For rural left-behind children, no relevant studies have been found, and whether the results are consistent remain unknown. However, multiple studies have suggested that physical exercise can significantly improve their self-esteem and mental health levels [16,17]. Given that SOC is a core concept of individual mental health - representing a stable psychological tendency - we hypothesize that physical exercise has a positive effect on the SOC of rural left-behind children (H1).

At present, there are fewer studies on the relationship between physical exercise and SOC, particularly regarding its impact on rural left-behind children. Does physical exercise influence the SOC of these children? In this study, we intend to examine the intrinsic relationship between physical exercise and SOC, with a view to provide theoretical support for the development of feasible interventions and promote SOC among left-behind children.

2. Objects and Methods

2.1 Participates

This study selected rural left-behind children in grades 4-9 as the research objects, with about 140 students per grade. The survey was administered in March 2022, yielding 804 valid questionnaires from 405 boys and 399 girls, aged between 9 and 15, with an average age of 11.86 ± 1.95 years. Prior to the survey, participants were informed about the purpose and confidentiality of this study, and consent was obtained for voluntary participation. Approval was also granted by relevant school administrators and class advisers. Questionnaires were collected immediately following the group survey. The collected data were organized, entered and preliminarily analyzed using statistical software.

2.2 Tools

(1) Physical Activity Rating Scale (PARS-3)

The PARS-3 revised by Liang, et. al [18] from Wuhan Institute of Physical Education was adopted. This scale evaluated the level of physical activity from three aspects: intensity,

duration and frequency, and scores were calculated as follows: Level of physical activity = intensity \times (duration-1) \times frequency. The test-retest reliability of the revised PARS-3 was 0.82, with the following activity level criteria: low activity = ≤ 19 , moderate activity = 20-42, and high activity = ≥ 43 . The internal consistency reliability of this study was 0.900.

(2) Children's Sense of Coherence Scale

The Children's Sense of Coherence Scale (SOC-13) was developed by Antonovsky [19] and subsequently revised into Chinese by Bao et al. [20] It contained 13 items, of which 6 were reverse-scored, covering three dimensions: comprehensibility, controllability and meaningfulness. A higher score indicated a higher SOC among the participants. The Chinese version encompassed these 13 items that measured the three dimensions: comprehensibility, controllability and meaningfulness. Relevant studies had pointed out that as the number of response points increased, the distribution of answers tended to broaden, which can lead to greater variance and loss of scale reliability [21]. For this reason, in this study, a Likert 5-point scoring system was employed. The internal consistency reliability of the scale was recorded at 0.979, demonstrating good reliability.

2.3 Statistical Method

Valid data were analyzed statistically using SPSS 21.0 software. The data were expressed as mean \pm standard deviation. Independent sample t-tests were utilized to examine the differences in physical exercise and SOC between left-behind children of different genders. Spearman correlation analysis was also conducted to investigate the strength of associations between variables, with $P < 0.05$ indicating statistical significance.

3. Results

3.1 Physical Exercise of the Rural Left-behind Children

The survey revealed that the average physical exercise score for the 804 rural left-behind children was 22.95 ± 23.24 . According to the activity level criteria, there were 450 students (56.0%) classified as having low activity, 202 (25.1%) as having moderate activity, and 152 (18.9%) as having high activity. Significant differences were observed between genders

regarding exercise intensity, frequency, duration, total score and activity level ($P<0.01$), with boys scoring higher than girls. See Tables 1 and 2 for details.

3.2 SOC of Rural Left-behind Children

The average total score of SOC among rural left-behind children was 34.65 ± 14.91 . While the scores for comprehensibility, controllability and meaningfulness were 13.32 ± 5.82 , 13.34 ± 5.83 and 7.99 ± 3.58 , respectively. Significant differences in total and dimensional scores of SOC were observed based on gender ($P<0.01$), with boys scoring higher than girls. See Table 3 for details.

3.3 Correlation Analysis between Physical Exercise and SOC

To further explore the correlation between physical exercise and SOC among rural left-behind children, we carried out Spearman correlation coefficient analysis. The results (see Table 4) indicated a positive correlation between physical exercise and the total and dimensional scores of SOC ($P<0.05$). To further validate the relationship between physical exercise and SOC, we treated SOC as a dependent variable, and physical activity and gender as independent variables for regression analysis. The results indicated that physical exercise and gender were significant positive predictors for SOC ($P<0.01$), as depicted in Table 5.

Table 1: Proportion of Physical Exercise among Rural Left-Behind Children (n=804)

Scoring	Exercise intensity		Exercise duration		Exercise frequency		Exercise level	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
0			121	15.0				
1	117	14.6	213	26.5	98	12.2	450	56.0
2	234	29.1	196	24.4	184	22.9	202	25.1
3	198	24.6	220	27.4	145	18.0	152	18.9
4	203	25.2	54	6.7	305	37.9		
5	52	6.5			72	9.0		
Totle	2.80 ± 1.16		1.84 ± 1.78		3.09 ± 1.20		1.63 ± 0.78	

Table 2: Gender-Based Comparison of Physical Exercise Scores in Rural Left-Behind Children (x±s)

Variable	Exercise intensity	Exercise duration	Exercise frequency	Scores
Male(405)	2.99 ± 1.05	2.01 ± 1.06	3.28 ± 1.06	24.89 ± 21.82
Female(399)	2.61 ± 1.24	1.67 ± 1.27	2.88 ± 1.30	20.98 ± 24.46
t	4.681	4.231	4.759	2.393
P	0.000	0.000	0.000	0.017

Table 3: Gender-Based Comparison of SOC Scores in Rural Left-Behind Children (x±s)

Variable	Comprehensibility	Controllability	Meaningfulness	SOC
Male(405)	14.08 ± 5.41	13.99 ± 5.39	8.41 ± 3.26	36.48 ± 13.67
Female(399)	12.55 ± 6.13	12.68 ± 6.19	7.57 ± 3.82	32.80 ± 15.88
t	3.747	3.184	3.382	3.518
P	0.000	0.000	0.001	0.000

Table 4: Correlation Analysis between Physical Exercise and SOC Children (n=804)

Variable	Comprehensibility	Controllability	Meaningfulness	SOC
Exercise intensity	0.253**	0.244**	0.240**	0.251**
Exercise duration	0.241**	0.221**	0.219**	0.232**
Exercise frequency	0.367**	0.343**	0.345**	0.359**
Physical exercise	0.286**	0.269**	0.266**	0.280**

Table 5: Regression Analysis of the Impact of Physical Exercise on SOC

Model		Non standardized coefficient		Standardized coefficient	t	P	95.0% CI	
		B	Standard error				Lower limit	Upper limit
1	(constant)	2.496	0.056		44.347	0.000	2.385	2.606
	Physical exercise	0.007	0.002	0.150	4.300	0.000	0.004	0.011
2	(constant)	2.889	0.135		21.401	0.000	2.624	3.154
	Physical exercise	0.007	0.002	0.141	4.039	0.000	0.004	0.010
	Gender	-0.256	0.080	-0.112	-3.203	0.001	-0.413	-0.099

4. Discussion

4.1 Status Quo and Characteristics of Physical Exercise in Left-behind Children

This study surveyed 804 rural left-behind children, and the results indicated an average physical exercise score of 22.95. Therein, 18% engaged in high activity, about 25% engaged in moderate activity, while a majority (56%) had low activity. These findings aligned with previous studies, such as those by Zhu Na and Huang [22], which suggested that only 16% of rural left-behind children frequently participated in physical exercise after class, with 65% participating occasionally and 20% never engaging in physical activity. Tu [23] also noted that rural left-behind children typically engaged in physical exercise infrequently, for shorter durations and at lower intensities, with most participating only 2-3 times per week for less than 30 minutes each session. In a survey of 797 left-behind children, Li and Ren [24] discovered that only 24.7% of the rural left-behind children engaged in moderate to high levels of physical activity, which was lower than the 44% reported in this study, possibly due to the fact that the Healthy China Initiative was effectively promoted in China, and the concept of prioritizing health has gradually taken root in people's minds.

An analysis of gender differences in physical exercise among left-behind children revealed that boys scored significantly higher than girls in terms of activity level, intensity, duration, and frequency, which was consistent with previous research by Li and Ren [24]. The social gender theory posited that differences between boys and girls stemmed not only from genetic factors, but also from social gender identity [25]. Socio-cultural norms generally portray males as strong and energetic, while females are seen as quiet and poised. Such stereotypes often lead boys to participate in more fierce and higher-intensity sports like basketball and soccer, while girls tend to engage in lower-intensity activities like aerobics and yoga [25]. In a word, the physical exercise levels among rural left-behind children are concerning, and low as a whole, particularly for girls, who exhibit insufficient duration and intensity in their physical exercise. Therefore, the issue of physical exercise among rural left-behind children, especially girls, deserves attention. The present study reminds that

physical education teachers should consider how to minimize differences in the level of physical activity due to gender when designing sports programs for children.

4.2 Status Quo and Characteristics of SOC in Left-behind Children

The results also indicated that rural left-behind children had an average SOC score of 34.65, categorized as lower-middle based on the scoring criteria. This aligned with Yang's research [26], which surveyed 370 left-behind junior middle school students and found similarly low SOC scores among them, although those scores were higher than in this study. The difference may stem from this study's inclusion of left-behind primary school students, leading to a relatively young age of the samples. Additionally, a recent study by Zhao et al. [27] involving 910 adolescents indicated that their SOC levels were generally higher than those observed among the left-behind children in this research, suggesting that left-behind children may experience delayed SOC development due to insufficient parental care. These findings provide valuable insights for increasing support for left-behind children and improving their well-being and holistic development.

The analysis of SOC among rural left-behind children indicated that boys scored higher than girls, which aligned with previous research [28]. Currently, there are few studies focusing the SOC of rural left-behind children. This study specifically targeted rural children in grades 4-9, many of whom were entering puberty and begun developing secondary sexual characteristics, with girls generally maturing earlier than boys. The secretion of hormones in girls not only affected their physiological traits, but also led to significant emotional fluctuations, confusion regarding self-identity, and other psychological distress. Additionally, girls tended to be more sensitive and often respond to life events more negatively [28], which led to lower SOC scores than boys. Therefore, educators are also reminded to strengthen the SOC of left-behind children, for instance, to improve their SOC scores by increasing social support for them through the encouragement and care, etc. of teachers.

4.3 Correlation Analysis between Physical Exercise and SOC in Left-behind Children

In this survey, we examined the correlation

between physical exercise and SOC among rural left-behind children. The results indicated a significant positive correlation between these two variables, suggesting an intrinsic connection between physical exercise and SOC that warranted further investigation. Previous studies had similar findings, noting a direct connection between SOC development in Chinese and participation in moderate to high-intensity physical activities, with the sense of revitalization and active engagement following exercise playing a notable role [16]. On the other hand, the level of SOC also influenced a child's attitude toward physical exercise; the higher their SOC, the more willing they were to take part in physical activities, the more easily they gained a sense of revitalization and active engagement, and the less fatigued they felt. This illustrated a reciprocal positive impact between physical exercise and SOC.

However, the present study also has some limitations, such as small sample size and single source of data. To begin with, although the participants were selected from several representative rural schools in Hunan Province, China, regional differences in the development levels of social culture and economy, and the living conditions of left-behind children necessitate a broader and larger-scale sampling survey to validate the robustness and applicability of the findings.

5. Conclusion

This study finds that rural left-behind boys has higher scores than girls in both physical exercise and SOC, indicating a significant gender disparity. Furthermore, there is a strong positive correlation between physical exercise and SOC. Specifically, physical exercise appears to directly influence SOC. This highlights the importance of promoting physical exercise among rural left-behind children, for example, by organizing various sports activities to encourage their participation. Such initiatives can help them develop a stable SOC and enhance their mental health, providing more concern and support in their developmental journey.

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