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Original Research Articles

Internal Control Significantly Improves the Corporate Social Responsibility Performance of Listed Companies in the Agriculture, Forestry, Animal Husbandry, and Fishery Sectors: Empirical Evidence from China

Junhui Wang[1], Hongjia Guo[1][a], Qingqing Jiang[2], Zhuming Zhao[3][b]

[1] School of Economics and Management, China University of Petroleum (East China), Qingdao, Shandong 266580, China, [2] Haidu College of Qingdao Agricultural University, Yantai, Shandong 265200, China, [3] Yellow Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences, Qingdao, Shandong 266071, China

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This paper investigates whether internal control improves corporate social responsibility (CSR) outcomes and whether ownership concentration moderates this link for China's agriculture, forestry, animal husbandry, and fishery (AFAHF) listed firms. Using 330 firm-year observations (2010-2021) and firm/year fixed-effects regressions, we find a positive and statistically significant association between internal control and CSR (5% level). Ownership concentration further strengthens this relationship, with the interaction term also significant at the 5% level. Robustness checks using an ordinal internal control measure and adding additional controls yield consistent results. These findings highlight a governance pathway through which stronger internal control supports CSR implementation in resource-based sectors and provide practical implications for regulators and firms seeking to enhance sustainable development in the AFAHF sectors.

1. INTRODUCTION

With the ongoing advancement of globalization and sustainable development, corporate social responsibility (CSR) has gradually become an important criterion for evaluating a company's overall competitiveness and capacity for sustainable growth. This is particularly true for listed companies in the agriculture, forestry, animal husbandry, and fishery sectors (AFAHF), which not only bear the responsibility of providing essential agricultural products and protecting the ecological environment, but also play a critical role in promoting socio-economic sustainability. Unlike other sectors, the AFAHF sectors are inherently linked to natural capital and public welfare. If CSR performance in these sectors is poor, it may not only lead to economic penalties or reputational damage, but also directly threaten ecosystem services, food security, and the livelihoods of rural communities. Therefore, effective CSR practices in these sectors are of strategic importance to the nation. Enhancing CSR performance among these enterprises remains an urgent and important issue to be addressed.

In the AFAHF sectors, CSR is tightly linked to day-to-day operations. Typical practices include controlling effluents and agricultural runoff; using antibiotics and pesticides prudently in aquaculture and livestock; conserving habitats and biodiversity; managing manure and other wastes; protecting and training seasonal and migrant workers; and implementing traceability for feed and other critical inputs. These sector-specific features link CSR outcomes directly to governance and process controls.

Against this sectoral background, internal control serves as a fundamental pillar of corporate governance, covering production management, operational processes, and financial activities.

When effectively implemented, it can elevate operational efficiency and strengthen the trustworthiness of financial disclosures. Accordingly, building robust internal control systems has become an essential approach for enterprises seeking sustainable growth. However, previous studies have seldom explored the influence of internal control on the corporate social responsibility (CSR) performance of listed companies in China's AFAHF sectors.

a Corresponding author. g1849881019@outlook.com (Hongjia Guo)

b Corresponding author. zhaozm@ysfri.ac.cn (Zhuming Zhao)

This paper empirically investigates the impact of internal control on CSR performance among Chinese listed firms in the AFAHF sectors. Employing comprehensive analysis and empirical validation, this research seeks to clarify how internal control contributes to better CSR practices and offer actionable guidance for policymakers and business leaders.

The key contributions of this study are summarized below. First, by centering on listed firms within the AFAHF sectors, it highlights sector-specific challenges and opportunities concerning environmental stewardship and social responsibility. Second, by applying empirical methods, the research systematically analyzes the association between internal control and CSR outcomes, thus adding new insights to existing scholarship. Finally, the empirical findings from China may serve as a valuable reference for other emerging economies.

Recent literature has shown that robust internal control systems contribute positively to the financial outcomes of organizations and firms. Additionally, when independent third parties verify corporate social responsibility disclosures and internal control mechanisms function effectively, ongoing financial results can be improved.[1] Adequate internal controls not only facilitate more informed decision-making by market participants but also boost the operational efficiency of enterprises.[2] Internal control is also crucial for ensuring high standards in accounting practices and the reliability of financial statements. Prior studies suggest that enhanced internal control and risk management frameworks can increase the credibility of accounting information.[3] Well-developed internal control is associated with greater accuracy in accounting estimations and better persistence of accruals.[4] High-quality internal control can improve a company's green information disclosure and environmental performance, while the level of digitalization serves as a mediating factor in this relationship.[5,6]

Internal control is instrumental in preventing accounting irregularities and improving the quality of investment decisions. Prior research finds that robust internal control frameworks are linked to a reduced likelihood of accounting fraud. It can weaken the connection between managerial ability and excessive investment, while at the same time reinforcing the relationship between managerial skill and prudent investment choices.[7,8] Further studies indicate that, in times of heightened economic policy uncertainty, firms with greater managerial ownership are more inclined to allocate resources to corporate social responsibility activities[9]; Additionally, aspects of corporate governance—such as an independent board, separation of the CEO and chair roles, and the establishment of a sustainability committee—have been shown to facilitate improved CSR disclosure.[10]

While most prior research has concentrated on financial outcomes, the direct mechanisms by which internal control affects CSR in AFAHF sectors have received limited attention. Existing studies often regard internal control as a secondary factor in CSR analysis, lacking focused and sector-specific investigation—particularly for the AFAHF sectors, where empirical evidence remains scarce. Additionally, much of the literature relies on data from developed countries. It rarely examines the relationship between internal control and CSR within China's unique institutional context.

In this study, agency theory is the primary basis for examining how internal control influences CSR outcomes. Within governance structures that separate ownership from management, managers may act in ways that do not align with shareholder interests due to information asymmetry and incentive misalignment. High-quality internal control mechanisms help mitigate agency issues by institutionalizing oversight, increasing transparency, and reinforcing management discipline. In practice, effective internal control reduces managerial moral hazard and short-termism by segregating duties, tightening authorization and budgeting procedures, and strengthening internal audit and compliance routines. These mechanisms increase the verifiability of non-financial information and embed environmental and social risks into planning and capital allocation, while also raising the reputational and regulatory costs of neglecting CSR. As agency frictions decline and incentives are better aligned, managers face clearer accountability to pursue long-horizon, value-preserving CSR investments—such as pollution abatement, supplier oversight, and worker safety programs—rather than myopic cost cutting.

Empirical research also provides support for this perspective. Strong internal control can constrain opportunistic managerial actions, enhance investment efficiency, and indirectly foster CSR outcomes. Furthermore, internal control demonstrates a notable positive association with environmental performance and advances the implementation of sustainable development practices.[6,8]

Therefore, this paper proposes the following hypothesis:

> H1: Internal control can significantly enhance the CSR performance of listed companies in the AFAHF sectors.

According to agency theory, ownership structure is an important factor affecting the effectiveness of governance mechanisms. When ownership is highly concentrated, controlling shareholders have stronger supervisory power and greater incentive to ensure that management acts in line with their long-term interests. This pattern is particularly evident in resource-based industries such as the AFAHF sectors, where active involvement of major shareholders can reinforce investment in social responsibility initiatives.

Prior research has also documented a strong association between ownership structure and CSR outcomes. A higher degree of ownership concentration is linked to improved CSR information disclosure, and ownership governance can influence the connection between internal control quality and CSR.[7,11]

Therefore, the second hypothesis is presented:

> H2: Ownership concentration moderates the relationship between internal control and CSR performance among listed companies in the AFAHF sectors.

2. MATERIALS AND METHODS

2.1. DATA SOURCES

This study selects A-share listed companies in China's AFAHF sectors from 2010 to 2021 as the research sample. After removing observations with missing data and excluding ST-designated firms, 330 valid firm-year observations were retained. All continuous variables were winsorized at the 1% level to reduce the influence of outliers. CSR performance data were obtained from Hexun.com, the internal control index was sourced from the Dibo Database, and additional variables were collected from the CSMAR database. All regression analyses were performed using STATA 15.

2.2. VARIABLE DEFINITIONS

2.2.1. *DEPENDENT VARIABLE*

We proxy CSR performance using Hexun's composite CSR score (0–100), which is constructed from listed firms' CSR reports and other public disclosures. Hexun aggregates information into five primary dimensions—shareholders, employees, customers/suppliers, environment, and society—covering 37 indicators. The provider applies a published weighting scheme and standardized coding rules, and adverse events (e.g., environmental penalties or product-safety incidents) are coded as deductions so that the score reflects both positive practices and unfavorable outcomes. The database offers broad coverage of Chinese A-share firms and uses a consistent methodology over time, enhancing cross-firm and intertemporal comparability. This measure has been used in research on Chinese listed firms.[12]

2.2.2. *INDEPENDENT VARIABLE*

We obtain IC from the Dibo "China Listed Firms Internal Control Index." Dibo constructs an annual composite score based on a standard internal-control framework and five target dimensions—strategy execution/achievement, operations, reporting, compliance, and asset security. A "base index" is first calculated from firms' public filings (internal-control self-assessment reports, annual reports, audit opinions), and then adjusted using disclosed material internal-control deficiencies as correction items to obtain the final score released for each firm–year. Following standard practice, we divide the score by 100 so that higher values indicate stronger and more effective internal control.[11]

2.2.3. *MODERATING VARIABLE*

A high level of ownership concentration can amplify the influence of internal control on CSR outcomes, since major shareholders—unlike minority investors—tend to prioritize both internal control and CSR implementation. In contrast, when ownership is more dispersed and management has greater autonomy, the absence of strong shareholder oversight may result in suboptimal CSR performance, even if internal control quality improves. Therefore, this study adopts ownership concentration (SHRCR) as the moderating variable.

2.2.4. *CONTROL VARIABLES*

Companies with a higher equity multiplier (EM) often experience greater financial pressure, which may shift management's focus toward short-term results and limit their engagement in social responsibility. When resources are constrained, firms may prioritize creditor and shareholder interests over broader social concerns. A larger supervisory board (SUPERVISOR) suggests the company places increased emphasis on oversight and governance, which can enhance CSR outcomes. Firms with higher Tobin's Q (TBQ) generally have stronger management practices and greater recognition from the market, supporting better fulfillment of social responsibility. As such, Tobin's Q is used as a control variable to account for the influence of market expectations. Consistent with prior research,[13] this study also includes firm size (LNASSET), return on equity (ROE), and leverage (LEV) as control variables. Year and firm fixed effects are also considered. Definitions for all variables are provided in **Table 1**.

2.3. MODEL SPECIFICATION

This study employs two regression models to test the proposed hypotheses, denoted as Model (1) and Model (2). Model (1) assesses the effect of internal control quality on CSR in AFAHF sectors. Model (2) adds an interaction term between internal control quality and ownership concentration to evaluate whether ownership concentration moderates the link between internal control and CSR.

$$\begin{aligned} CSR_{i,t} =& \beta_0 + \beta_1 IC_{i,t} + \beta_2 LNASSET_{i,t} \\ &+ \beta_3 EM_{i,t} + \beta_4 ROE_{i,t} \\ &+ \beta_5 SUPERVISOR_{i,t} \\ &+ \beta_6 TBQ_{i,t} + \beta_7 LEV_{i,t} + \Sigma YEAR \\ &+ \Sigma ID + \varepsilon_{i,t} \end{aligned} \tag{1}$$

$$\begin{aligned} CSR_{i,t} =& \beta_0 + \beta_1 IC_{i,t} + \beta_2 \text{ SHRCR }_{i,t} \\ &+ \beta_3 (C\_IC_{i,t} \times C\_\text{SHRCR }_{i,t}) \\ &+ \beta_4 LNASSET_{i,t} + \beta_5 EM_{i,t} \\ &+ \beta_6 \text{ ROE }_{i,t} + \beta_7 \text{ SUPERVISOR }_{i,t} \\ &+ \beta_8 TBQ_{i,t} + \beta_9 LEV_{i,t} + \Sigma YEAR \\ &+ \Sigma ID + \varepsilon_{i,t} \end{aligned} \tag{2}$$

3. RESULTS

3.1. DESCRIPTIVE

Table 2 reports summary statistics for the key variables. The average CSR score is 18.7, ranging from -11.29 to 69.48, with a standard deviation of 15.97, reflecting considerable dispersion in CSR performance across AFAHF firms. The average internal control quality (IC) is 6.47, with a standard deviation of 0.927, indicating that most firms have similar levels of internal control, though a minority display relatively low IC scores.

Regarding ownership concentration (SHRCR), the average is 52.98% with a standard deviation of 14.57, indicating that the top 10 shareholders typically hold more than 50%

Table 1. Variable Names and Definitions

Variable Type	Symbol	Variable Name	Definition
Dependent Variable	CSR	CSR Performance	Total CSR score of listed companies from Hexun.com
Independent Variable	IC	Internal Control Quality	Dibo internal control index divided by 100
Moderating Variable	SHRCR	Ownership Concentration	Sum of shareholding ratios of the top 10 shareholders
Control Variable	LNASSET	Firm Size	Natural logarithm of total assets
	EM	Equity Multiplier	Total assets / Total equity
	ROE	Return on Equity	Net profit / Ending shareholders' equity
	SUPERVISOR	Size of Supervisory Board	Total number of supervisors
	TBQ	Tobin's Q	Market value / Total assets
	LEV	Leverage Ratio	Total liabilities / Total assets

Table 2. Descriptive Statistics Results

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	mean	sd	min	max
CSR	330	18.70	15.97	-11.29	69.48
IC	330	6.470	0.927	2.094	9.071
SHRCR	330	52.98	14.57	22.13	80.69
LNASSET	330	21.84	0.994	19.48	25.53
EM	330	2.006	1.991	1.052	35.52
ROE	330	0.033	0.185	-1.343	0.604
SUPERVISOR	330	3.542	0.935	2	9
TBQ	330	2.345	1.493	0.896	17.93
LEV	330	0.417	0.174	0.0496	0.972

of shares, reflecting a relatively concentrated ownership structure.

For the control variables, the mean firm size (LNASSET) is 21.84 with a small standard deviation (0.994), showing that the sample firms are similar in size. The mean equity multiplier (EM) is 2.006 with a standard deviation of 1.991, indicating significant variation in financial leverage and relatively high debt levels for some firms. Return on equity (ROE) ranges from -1.343 to 0.604, suggesting that some companies may be operating at a loss. The mean supervisory board size (SUPERVISOR) is 3.542, with a minimum of 2 and a maximum of 9, indicating some diversity in governance structures. The mean Tobin's Q (TBQ) is 2.345 with a standard deviation of 1.493, showing large fluctuations between market and asset values among firms. The mean leverage ratio (LEV) is 0.417 with a standard deviation of 0.174, reflecting a moderate debt level overall but higher leverage for some firms.

Overall, the control variables show moderate variability, reflecting differences among sample firms regarding financial structure, market performance, and governance mechanisms.

3.2. CORRELATION ANALYSIS

Table 3 summarizes the correlation analysis for the main variables. The findings show that internal control quality (IC) exhibits a positive correlation with CSR, with a coefficient of 0.331, which is statistically significant at the 1% level. This suggests notable variation in CSR performance linked to internal control quality among AFAHF enterprises. However, to further clarify these associations, regression analysis is necessary. Additionally, variance inflation factor (VIF) tests were conducted, revealing a maximum VIF of 1.76 and an average of 1.33, which confirms that multicollinearity is not a concern in this dataset.

3.3. REGRESSION ANALYSIS

To test the above hypotheses, this study employs multiple regression analysis. Based on the results of the Hausman test, the fixed effects model was selected for the regressions. Prior to testing Hypothesis H2, both the independent variable (internal control quality, IC) and the moderating variable (ownership concentration, SHRCR) were mean-centered, and the interaction term (C_IC*C_SHRCR) was constructed for regression analysis. The regression results are presented in Table 4. In both models, ownership concentration's effect on CSR is insignificant, indicating that ownership concentration itself has a relatively weak impact on CSR performance.

Table 3. Correlation Matrix

	CSR	IC	SHRCR	LNASSET	EM	ROE	SUPERVISOR	TBQ	LEV
CSR	1								
IC	0.331***	1							
SHRCR	0.221***	0.106*	1						
LNASSET	0.140**	0.203***	0.0400	1					
EM	-0.092*	-0.275***	0.0320	0.0380	1				
ROE	0.393***	0.330***	0.0780	0.196***	-0.0460	1			
SUPERVISOR	-0.133**	0.0160	-0.122**	-0.107*	-0.00200	-0.0250	1		
TBQ	0.0740	0.0110	-0.0540	-0.366***	-0.0850	0.0320	0.178***	1	
LEV	-0.186***	-0.0720	0.0540	0.229***	0.490***	-0.283***	-0.0210	-0.317***	1

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 4. Regression Results for Main Effects and Moderating Effects

	(1)	(2)
	CSR	CSR
IC	2.6472**	2.5645**
	(2.3546)	(2.6548)
SHRCR	0.0795	0.0902
	(0.5389)	(0.6022)
C_IC*C_SHRCR		0.1449**
		(2.3353)
LNASSET	1.0714	0.8169
	(0.4527)	(0.3387)
EM	-0.4023	-0.3123
	(-1.0754)	(-0.8774)
ROE	19.2584***	17.7309***
	(3.5833)	(3.3353)
SUPERVISOR	-0.1528	-0.0485
	(-0.1339)	(-0.0426)
TBQ	-0.2671	-0.3718
	(-0.3565)	(-0.5112)
LEV	-17.1406	-18.7297*
	(-1.5474)	(-1.7112)
YEAR/ID	YES	YES
_cons	-14.3549	-9.3771
	(-0.2647)	(-0.1727)
N	330	330
R^2	0.3692	0.3872

Note: All regressions include firm and year fixed effects. Robust t statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

3.3.1. *INTERNAL CONTROL AND CSR PERFORMANCE*

As shown in column (1) of Table 4, the coefficient of internal control quality (IC) is significantly positive at the 5% level, indicating a significant positive relationship between internal control quality and CSR performance among listed companies in China's agriculture, forestry, animal husbandry, and fishery sectors. This finding supports Hypothesis H1. It implies that by improving internal control quality, these companies can effectively enhance their CSR performance. Improvements in internal control quality are usually accompanied by optimized corporate governance and more standardized risk management and decision-making processes, making firms more attentive to fulfilling social responsibilities, improving corporate image, and gaining social recognition.

3.3.2. *MODERATING EFFECT OF OWNERSHIP CONCENTRATION*

As shown in column (2) of **Table 4**, the interaction term between internal control (IC) and ownership concentration (SHRCR), C_IC * C_SHRCR, has a coefficient of 0.1449, which is significant at the 5% level (t = 2.3353). This indicates that ownership concentration has a significant positive moderating effect on the relationship between internal control and CSR performance. When ownership concentration is higher, the positive impact of internal control on CSR performance is further strengthened. Higher ownership concentration gives major shareholders greater supervisory and decision-making power in corporate governance. Major shareholders are typically more motivated to ensure the effectiveness of internal control mechanisms, thereby improving CSR performance. This result confirms Hypothesis H2 and suggests that ownership concentration is an important moderating factor in the impact of internal control on CSR performance.

3.4. ROBUSTNESS CHECKS

3.4.1. *REPLACING THE INDEPENDENT VARIABLE*

In previous literature,[14] the internal control quality (IC) was divided into quartiles based on 25% intervals to generate a new variable, IC_4, which replaces the original independent variable for robustness testing. The internal control levels of each group, from lowest to highest, are assigned values of 1, 2, 3, and 4, respectively. As shown in column (1) of **Table 5**, internal control quality remains significantly positively associated with CSR performance, indicating that the empirical results of this study are robust.

Table 5. Results of Robustness Checks

	(1)	(2)
	CSR	CSR
IC_4	2.0828***	
	(2.7198)	
IC		2.9191**
		(2.8208)
LNASSET	2.8493***	2.9090*
	(3.1338)	(1.9337)
EM	0.1116	0.3411
	(0.2549)	(1.1085)
ROE	21.8537***	21.2770***
	(4.7003)	(6.0564)
SUPERVISOR	-2.5946***	-2.6883***
	(-3.2386)	(-5.4020)
TBQ	1.3255**	1.3341*
	(2.2168)	(1.8107)
LEV	-11.0706*	-12.9366**
	(-1.9604)	(-2.2538)
AUDIT		-2.9342
		(-0.9525)
SALARY		-0.2502
		(-0.4387)
YEAR/ID	YES	YES
_cons	-38.9758*	-46.8194
	(-1.9582)	(-1.5502)
N	330	330
R^2	0.2539	0.2586

Note: All regressions include firm and year fixed effects. Robust t statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

3.4.2. *ADDING CONTROL VARIABLES*

Robustness was further tested by including additional control variables: audit opinion (AUDIT) and executive compensation (SALARY). As shown in column (2) of **Table 5**, the regression results indicate that internal control quality remains significantly associated with CSR performance after adding these control variables. The regression coefficient is 2.919, and the effect is significant at the 1% level, confirming that the previous empirical findings are robust to the inclusion of additional control variables.

4. DISCUSSION

4.1. CONCLUSION

Based on an empirical analysis of listed companies in China's agriculture, forestry, animal husbandry, and fishery sectors, this study concludes that the quality of internal control significantly enhances corporate social responsibility (CSR) performance. High-quality internal control, by improving corporate governance efficiency, reducing risk, and increasing transparency, encourages companies to actively fulfill their social responsibilities. Well-established internal control systems lead to more proactive CSR practices and enhance public trust and social recognition. In addition, the study finds that ownership concentration has a significant positive moderating effect on the relationship between internal control and CSR performance. In firms with higher ownership concentration, major shareholders strengthen supervision over management, further improving the effectiveness of internal control and thus promoting better CSR performance. The active involvement of major shareholders in corporate governance plays an important role in fostering CSR.

4.2. RECOMMENDATIONS

Given that stronger internal control (IC) is positively associated with CSR performance-and that this association intensifies with higher ownership concentration-listed firms in the AFAHF sectors should embed CSR into their control architecture rather than treat it as a stand-alone program. Concretely, boards or sustainability committees can place environmental and labor risks onto the IC risk register, require internal audit to test CSR-related controls, and ensure that process controls reflect sectoral realities (e.g., routine water-quality and effluent monitoring in aquaculture, antibiotic-use approvals and logs, manure and waste management in animal husbandry, and supplier oversight with traceability of feed and veterinary inputs). Major shareholders, whose presence strengthens the IC-CSR linkage, are well-positioned to exercise stewardship by setting measurable CSR targets, monitoring audited indicators, and aligning executive compensation with verified CSR KPIs, thus converting governance power into sustained operational improvements.

At the policy level, the evidence that IC supports CSR suggests prioritizing rules and incentives that raise the quality and verifiability of control systems. Regulators can issue sector-specific disclosure guidance and require limited assurance for key CSR metrics so that the information tested by internal audit is decision-useful and comparable. Eligibility for tax credits, fee reductions, or green finance can be conditioned on demonstrable improvements in IC quality and CSR outcomes, creating a clear "controls-to-performance" pathway. Capacity-building programs-especially for smaller listed firms and their upstream suppliers-can focus on integrating IC with environmental and labor controls and adopting recognized management systems (e.g., ISO 14001/45001, HACCP). Finally, stewardship codes and enhanced disclosure of shareholder engagement would encourage active monitoring by blockholders, reinforcing the moderating role of ownership concentration documented in this study.

4.3. LIMITATIONS AND FUTURE RESEARCH

This study has several limitations. First, potential endogeneity remains: simultaneity and reverse causality between IC and CSR may bias the coefficients, even with firm and year fixed effects and extensive controls. We therefore refrain from strong causal claims and view the estimates as conditional associations. Second, our CSR measure relies on Hexun's index; although widely used, it may not capture all aspects of CSR quality. Third, the sample focuses on AFAHF firms in China, which may limit generalizability to other sectors or institutional settings. Future research could adopt instrumental-variable or quasi-experimental designs (e.g., industry–province diffusion instruments, audit-firm industry expertise, or staggered regulatory shocks), incorporate alternative CSR proxies, and examine dynamic effects of ownership concentration.

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AUTHORS' CONTRIBUTION

Conceptualization: Junhui Wang (Equal), Hongjia Guo (Equal), Qingqing Jiang (Equal), Zhuming Zhao (Equal). Writing – review & editing: Junhui Wang (Equal), Hongjia Guo (Equal), Qingqing Jiang (Equal). Funding acquisition: Junhui Wang (Equal), Zhuming Zhao (Equal). Supervision: Junhui Wang (Lead). Formal Analysis: Hongjia Guo (Equal), Qingqing Jiang (Equal). Validation: Hongjia Guo (Equal), Zhuming Zhao (Equal). Writing – original draft: Hongjia Guo (Equal), Qingqing Jiang (Equal). Software: Hongjia Guo (Lead). Project administration: Hongjia Guo (Lead). Visualization: Hongjia Guo (Lead). Data curation: Qingqing Jiang (Lead). Investigation: Qingqing Jiang (Lead), Zhuming Zhao (Equal). Resources: Zhuming Zhao (Lead).

CONFLICT OF INTEREST STATEMENT

The authors declare that the research was conducted without any commercial or financial relationships that could potentially create a conflict of interest.

DATA ACCESSIBILITY

The datasets generated and/or analyzed during the current study are available from the corresponding authors upon reasonable request.

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