

Volume - 62 No. 1
QUARTERLY
July 2026 to September 2026



International Federation of
Physical Education, Fitness and
Sports Science Association

www.ifpefssa.org



ISSN 2231-3265
(Online and Print)

International Journal of Health, Physical Education & Computer Science in Sports

www.ijhpecss.org

A Peer Reviewed (Refereed)
International Research Journal

Published by :

Indian Federation of Computer Science in Sports

www.ijhpecss.org & www.ifcss.in

ISRA Journal Impact Factor 7.217
Index Journal of



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International Journal of Health, Physical Education and Computer Science in sports ISSN 2231-3265 (On-line and Print) ISRA Journal Impact factor is 6.997. Journal published Quarterly for the months of March, June, September and December. IJHPECSS is refereed Journal. Index Journal of Directory of Research Journal Indexing, J-Gate, 120R etc.

International Journal of Health, Physical Education and Computer Science in Sports is multidisciplinary peer reviewed journal, mainly publishes original research articles on Health, Physical Education and Computer Science in Sports, including applied papers on sports sciences and sports engineering, computer and information, health managements, sports medicine etc. The International Journal of Health, Physical Education and Computer Science in sports is an open access and print International journal devoted to the promotion of

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Publisher

Indian Federation of Computer Science in sports,
www.ijhpecss.org and www.ifcss.in under the auspices of
International Association of Computer Science in sports.
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Research Article

Selection of indicators for assessing the economic impact of sports events: A case study in Ho Chi Minh City

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ABSTRACT

This study selects a system of indicators for assessing the economic impact of sports events under the practical data conditions of Ho Chi Minh City (HCMC). Drawing on a literature review, 22 preliminary indicators were developed and assessed by 30 experts, including researchers, lecturers, managers, and practitioners experienced in sports management, sport economics, and event organization. Indicators were assessed for relevance and cross-checked against data availability, measurability, and the risk of double counting. The selection resulted in 15 indicators in four groups: Participant scale and characteristics; event-related direct revenue; event-related expenditure by participants and accompanying persons; and aggregated results and estimated impact. The system is organized into three levels: Input indicators, intermediate aggregation or extrapolation indicators, and estimated output indicators. The findings provide a feasible monitoring framework for sports events in HCMC and emphasize the need to distinguish event-related cash flows from value added or the actual contribution to gross regional domestic product.

Keywords: Assessment indicators, Economic development, Event management, Ho Chi Minh City, Sports events

INTRODUCTION

Sports events are increasingly connected with urban services, tourism, media, and commercial activity. In Vietnam, however, post-event reports commonly focus on participation, sporting results, or registration-fee revenue. This approach does not fully capture expenditure generated during participation, the role of visitors from outside the locality and accompanying persons, or other revenue sources associated with the event.

Methodologically, economic-impact assessment requires a correct definition of the expenditure boundary, the origin of cash flows, and potential leakage from the locality. Crompton (1995) cautioned against equating observed total expenditure with net economic impact. Agha and Taks (2015, 2018) likewise stressed the need to distinguish expenditure by residents, non-local visitors, and expenditure that may be displaced. OECD guidance (2023a, 2023b) recommends indicator systems appropriate to the event type and to available data.

In Ho Chi Minh City (HCMC), large running and marathon events attract participants from many provinces and generate demand for accommodation, food and beverage, transport, and shopping. Yet, no unified indicator system is both scientifically grounded and practicable with organizer records and participant-survey data. This article therefore selects indicators for assessing the economic impact of sports events on economic development, using seven running and marathon events held in HCMC during 2023–2024 as a case study.

RESEARCH METHODS

Research Design

The study was conducted in three stages. First, domestic and international literature on sports events, event tourism, economic-impact assessment, and indicator-system guidance was reviewed and synthesized. Second, 22 preliminary indicators were developed to reflect participant scale, revenue, expenditure, and impact results. Third, the list was submitted to expert consultation to screen the indicators, refine their names, and determine their applicability.

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Consultation Participants and Instrument

The consultation panel comprised 30 individuals experienced in sports management, event organization, sport economics, research, and education. Each indicator was assessed on a five-point Likert scale, from 1 (completely inappropriate) to 5 (completely appropriate). A mean score of 4.50 or above was used as the priority screening threshold. Scores alone were not decisive: An indicator was retained only when it could be identified from practical data sources, quantified with reasonable consistency across events, and did not overlap substantively with other indicators.

Data Processing and Interpretation Principles

Results were processed using descriptive statistics, including means and standard deviations. Following consultation, indicators were classified by their data source and formation process. This was an operational selection procedure within the scope of the study, rather than psychometric scale validation or the construction of a standardized index set for all types of sports events.

RESEARCH RESULTS

Basis for Developing the Preliminary Indicator System

The preliminary indicator system for assessing the economic impact of sports events on economic development in HCMC was developed from theoretical perspectives on sports events and associated cash flows; a review of domestic and international studies; the characteristics of the events within the study scope; and practical conditions for collecting, processing, and aggregating data.

Studies by Crompton (1995), Preuss (2007), Agha and Taks (2015, 2018), Dwyer *et al.* (2005), together with OECD guidance (2023a, 2023b), indicate that assessment should consider participant scale, place of residence, length of stay, event revenue sources, and locally generated expenditure. This approach identifies cash flows associated with organizing and attending an event rather than treating participation or registration-fee revenue as a proxy for all impact.

For the HCMC case, the system was developed for seven community running and marathon events held in 2023–2024. Event scale is expressed as participation instances or registrations. Since one person may take part in more than one event during the study period, total participation instances must not be interpreted as the number of unique individuals.

The indicator system addresses three connected requirements. It must reflect participant scale and characteristics – residence, length of stay, and accompanying persons – because these are associated with service demand during the event. It must

also record consistently available direct revenue, namely registration fees, sponsorship, and advertising. Finally, it must permit the aggregation of event-related expenditure and estimated results in a clear sequence without conflating revenue, expenditure, total direct cash flow, organizer profit, value added, and an actual contribution to gross regional domestic product (GRDP).

Accordingly, four groups were identified. Participant scale and characteristics describe the ability to attract participants, residence and stay patterns, and accompanying persons. Direct revenue records receipts associated with event delivery and commercial exploitation. Event-related expenditure records spending linked to participation by participants and accompanying persons. The impact-results group aggregates revenue and expenditure to establish total direct cash flow, estimated total impact under a multiplier scenario, and a reference ratio relative to HCMC GRDP.

Indicators do not all represent the same analytical level. Some are inputs observed directly from event reports or participant surveys, including participation instances, residence, length of stay, accompanying persons, revenue, and expenditure. Others are aggregated or extrapolated from inputs, such as total direct revenue and total expenditure by participants and accompanying persons. The remaining indicators are calculated results: total direct cash flow, total estimated impact, and the comparison with HCMC GRDP. This distinction clarifies data provenance and the interpretation limits of each indicator.

For revenue and expenditure, the study applies a double-counting control principle. Registration fees recorded as event revenue are not included again in participants' event-related expenditure. Shared spending by participants and accompanying persons is reviewed before aggregation. Total direct cash flow represents the scale of event-related cash flows; it is not organizer profit or local value added. Likewise, total impact estimated using a multiplier is interpreted only within the selected scenario and methodological assumptions. The GRDP comparison is a reference to relative scale, not the event's direct contribution to HCMC GRDP.

On this basis, the study developed 22 preliminary indicators for expert consultation, screening, and completion of the official system.

Selection and completion of indicators assessed the economic impact of sports events on economic development in HCMC.

From the 22 preliminary indicators, the study consulted 30 researchers, lecturers, managers, and practitioners in sports management, sport economics, and sports-event organization. Consultation focused on each indicator's relevance to

Table 1: Preliminary indicator system for assessing the economic impact of sports events on economic development in HCMC

No.	Preliminary indicator	References and rationale
1	Number of sports-event participation instances	Derived and adapted from the references cited in the article; the indicator captures the corresponding event-related dimension.
2	Number of on-site sports-event spectators	Derived and adapted from the references cited in the article; the indicator captures the corresponding event-related dimension.
3	Proportion of participants residing outside HCMC	Derived and adapted from the references cited in the article; the indicator captures the corresponding event-related dimension.
4	Average length of stay of sports-event participants	Derived and adapted from the references cited in the article; the indicator captures the corresponding event-related dimension.
5	Average accompanying persons per participation instance	Aggregated indicator derived from the relevant component data, with double-counting controls applied where appropriate.
6	Ticket or registration-fee revenue	Derived and adapted from the references cited in the article; the indicator captures the corresponding event-related dimension.
7	Sports-event sponsorship revenue	Derived and adapted from the references cited in the article; the indicator captures the corresponding event-related dimension.
8	Sports-event advertising revenue	Derived and adapted from the references cited in the article; the indicator captures the corresponding event-related dimension.
9	Revenue from booths and commercial activities	Derived and adapted from the references cited in the article; the indicator captures the corresponding event-related dimension.
10	Revenue from product and souvenir sales	Derived and adapted from the references cited in the article; the indicator captures the corresponding event-related dimension.
11	Total event-related direct revenue	Indicator constructed for this study from the relevant data sources and methodological principles stated in the article.
12	Average event-related expenditure of sports-event participants	Derived and adapted from the references cited in the article; the indicator captures the corresponding event-related dimension.
13	Total event-related expenditure of sports-event participants	Indicator constructed for this study from the relevant data sources and methodological principles stated in the article.
14	Total event-related expenditure of accompanying persons	Aggregated indicator derived from the relevant component data, with double-counting controls applied where appropriate.
15	Average event-related expenditure of participants residing outside HCMC	Derived and adapted from the references cited in the article; the indicator captures the corresponding event-related dimension.
16	Event-related expenditure structure by service group	Derived and adapted from the references cited in the article; the indicator captures the corresponding event-related dimension.
17	Total event-related expenditure of participants and accompanying persons	Indicator constructed for this study from the relevant data sources and methodological principles stated in the article.
18	Total event-related direct cash flow	Indicator constructed for this study from the relevant data sources and methodological principles stated in the article.
19	Estimated ripple impact	Indicator constructed for this study from the relevant data sources and methodological principles stated in the article.
20	Total estimated impact of sports events on economic development in HCMC	Indicator constructed for this study from the relevant data sources and methodological principles stated in the article.
21	Estimated impact per participation instance	Indicator constructed for this study from the relevant data sources and methodological principles stated in the article.
22	Ratio of total estimated impact to HCMC GRDP	Indicator constructed for this study from the relevant data sources and methodological principles stated in the article.

Source: Compiled by the authors. HCMC: Ho Chi Minh City, GRDP: Gross regional domestic product

the research objective, capacity to represent the required dimension, measurability, and practical data-collection conditions.

Indicators were assessed on a five-point Likert scale: 1 = completely inappropriate; 2 = inappropriate; 3 = undecided; 4 = appropriate; and 5 = completely appropriate. Results were summarized by mean and standard deviation and considered together with scientific rationale, data availability, calculation feasibility, and overlap between indicators.

A mean score of 4.50 or higher was used as the screening threshold for inclusion in the official system. In addition to meeting this score, an indicator had to fit the study scope, be identifiable from administrative or survey data, be applied relatively consistently across events, and not duplicate another indicator. The 4.50 threshold is a study-specific screening rule intended to prioritize highly rated indicators that are operationally feasible.

Table 2 shows that the means for the 22 indicators ranged from 4.03 to 4.97 and standard deviations from 0.18 to 0.76. The 15 selected indicators had means of 4.57–4.97 and standard deviations of 0.18–0.50. The remaining indicators scored 4.03–4.17, with standard deviations of 0.61–0.76. Although the unselected indicators were generally rated as appropriate, they did not meet the 4.50 priority threshold or had limitations in data sources, calculation, or independence within the official system.

Based on consultation findings and practical implementation conditions, 15 indicators were selected in four groups.

The participant scale and characteristics group includes four indicators: Number of sports-event participation instances; proportion of participants residing outside HCMC; average length of stay; and average number of accompanying persons per participation instance. These indicators reflect participation scale and characteristics associated with expenditure during attendance. Distinguishing participants by residence identifies visitors from outside HCMC and supports comparison of spending patterns between groups.

The event-related direct-revenue group includes four indicators: Ticket or registration-fee revenue; sponsorship revenue; advertising revenue; and total event-related direct revenue. They record revenue that can be consistently aggregated from information on the events studied. Total direct revenue is confined to the selected revenue sources and is not equivalent to organizer profit or local value added.

The incremental-expenditure group includes four indicators: Average event-related expenditure per participant; total event-related expenditure by participants; total event-related

expenditure by accompanying persons; and total event-related expenditure by participants and accompanying persons. Considering both groups makes it possible to identify spending on accommodation, food and beverage, transport, shopping, and other services during the event in HCMC.

The economic-impact group includes three indicators: Total event-related direct cash flow; total estimated economic impact of sports events on economic development in HCMC; and the ratio of total estimated impact to HCMC GRDP. These are determined by aggregating revenue, event-related expenditure, and the estimates generated by the study method. The GRDP ratio is solely a reference to relative scale, not a direct contribution rate to GRDP.

Seven indicators were not retained as independent official indicators. Their exclusion does not mean that the corresponding matters lack scientific or practical value; it reflects differences in priority, data conditions, and analytical roles.

The indicator “number of on-site spectators” scored 4.03. It is relevant to event scale but was not selected because consistent spectator data were unavailable for the events studied. Spectator counts may also overlap with accompanying persons or persons present in the event area who did not participate directly.

Revenue from booths and commercial activities scored 4.17, while revenue from product and souvenir sales scored 4.03. Although these may arise during event organization, they were not selected because separately identified and consistent data were unavailable. Some purchases may also have been recorded in participant or accompanying-person expenditure, creating a risk of double counting.

Average event-related expenditure of participants residing outside HCMC scored 4.13. While useful for identifying residence-based spending differences, it was not retained as an independent indicator because it is used as disaggregation information when determining average participant expenditure and total participant expenditure. Its exclusion therefore does not remove expenditure data for non-HCMC residents.

The expenditure structure by service group scored 4.10. It provides information on the shares spent on accommodation, food and beverage, transport, shopping, and other services but was not selected as an official indicator because its role is primarily supplementary analysis. Such information can still explain findings and support recommendations linking sports events with tourism, commerce, and services.

Estimated ripple impact scored 4.17. It was not selected independently because the study has no input–output data or social accounting matrix to separately identify indirect and

Table 2: Consultation-panel assessment of the preliminary indicator system for evaluating the economic impact of sports events on economic development in HCMC ($n=30$)

Indicator group	Preliminary indicator	Mean	Standard deviation	Selection result and treatment
I. Participant scale and characteristics	1. Number of sports-event participation instances.	4.93	0.25	Selected as an official indicator.
	2. Number of on-site sports-event spectators.	4.03	0.72	Not selected; no consistent spectator data.
	3. Proportion of participants residing outside HCMC.	4.80	0.41	Selected as an official indicator.
	4. Average length of stay of participants.	4.87	0.35	Selected as an official indicator.
	5. Average accompanying persons per participation instance.	4.57	0.50	Selected as an official indicator.
II. Event-related direct revenue	6. Ticket or registration-fee revenue.	4.87	0.35	Selected as an official indicator.
	7. Sponsorship revenue.	4.80	0.41	Selected as an official indicator.
	8. Advertising revenue.	4.60	0.50	Selected as an official indicator.
	9. Revenue from booths and commercial activities.	4.17	0.70	Not selected; no separate data and risk of double counting.
	10. Revenue from product and souvenir sales.	4.03	0.76	Not selected; no separate data and risk of double counting.
III. Event-related expenditure by participants and accompanying persons	11. Total event-related direct revenue.	4.93	0.25	Selected as an official indicator.
	12. Average event-related expenditure of participants.	4.97	0.18	Selected as an official indicator.
	13. Total event-related expenditure of participants.	4.93	0.25	Selected as an official indicator.
	14. Total event-related expenditure of accompanying persons.	4.70	0.47	Selected as an official indicator.
	15. Average event-related expenditure of participants residing outside HCMC.	4.13	0.63	Not selected; used for residence-based disaggregation and spending comparison.
	16. Event-related expenditure structure by service group.	4.10	0.61	Not selected; used for supplementary service-group analysis.
	17. Total event-related expenditure of participants and accompanying persons.	4.90	0.31	Selected as an official indicator.
IV. Economic impact of sports events on HCMC development	18. Total event-related direct cash flow.	4.90	0.31	Selected as an official indicator.
	19. Estimated ripple impact.	4.17	0.65	Not selected; used as a supplementary estimated result.
	20. Total estimated impact of sports events on economic development in HCMC.	4.97	0.18	Selected as an official indicator.
	21. Estimated impact per participation instance.	4.13	0.63	Not selected; can be calculated from selected indicators.
	22. Ratio of total estimated impact to HCMC GRDP.	4.83	0.38	Selected as an official indicator.

Source: Consultation survey results. An indicator was selected if its mean was at least 4.50 and it was consistent with the research objective, data-collection conditions, calculation feasibility, and the requirement to limit double counting. Indicators not selected independently may still be used as supplementary analytical information or calculation parameters. HCMC: Ho Chi Minh City, GRDP: Gross regional domestic product

induced effects. The ripple component is calculated only as the difference between total estimated impact and total direct

cash flow. It is therefore a supplementary calculation rather than an independently measured indicator.

Table 3: Results of selecting indicators for assessing the economic impact of sports events on economic development in HCMC

Indicator group	Official indicator
Group 1. Participant scale and characteristics	1. Number of sports-event participation instances.
	2. Proportion of participants residing outside HCMC.
	3. Average length of stay of participants.
	4. Average accompanying persons per participation instance.
Group 2. Event-related direct revenue	5. Ticket or registration-fee revenue.
	6. Sponsorship revenue.
	7. Advertising revenue.
Group 3. Event-related expenditure by participants and accompanying persons	8. Total event-related direct revenue.
	9. Average event-related expenditure of participants.
	10. Total event-related expenditure of participants.
	11. Total event-related expenditure of accompanying persons.
Group 4. Economic impact of sports events on HCMC development	12. Total event-related expenditure of participants and accompanying persons.
	13. Total event-related direct cash flow.
	14. Total estimated impact of sports events on economic development in HCMC.
	15. Ratio of total estimated impact to HCMC GRDP.

Source: Consultation survey results. HCMC: Ho Chi Minh City, GRDP: Gross regional domestic product

Estimated impact per participation instance scored 4.13. It is derived from total estimated impact and participation instances. Because it supplies no independent data source and can be calculated when comparisons are needed, it was not included in the official system.

The final system thus contains four groups and 15 indicators: Four for participant scale and characteristics; four for event-related direct revenue; four for event-related expenditure by participants and accompanying persons; and three for economic impact on HCMC development. The system is used consistently to collect, aggregate, analyze, and estimate the impact of events within the study scope.

Consultation results are reported as the mean and standard deviation for each indicator. Because the study does not present the distribution of respondents across score categories, these values must not be converted into a consensus percentage. The 4.50 score is a screening threshold, not evidence that 90% of panellists agreed or gave the same rating.

Following consultation, several indicator names were reviewed and standardized to align with the unit of analysis, data scope, and interpretation. Revisions focused on “participation instances,” “event-related expenditure,” “total event-related direct revenue,” “total event-related direct cash flow,” and “estimated ripple impact.” The scores represent consultation on the corresponding substantive content; standardizing labels refined the system and does not indicate that an additional survey round was conducted.

Content, Data Sources, and Identification of Indicators for Assessing the Economic Impact of Sports Events on Economic Development in HCMC

Based on data sources and formation processes, the indicator system is divided into three levels: Input indicators identified directly from original data; intermediate aggregation or extrapolation indicators; and output indicators for estimating and referencing impact. Details are provided in Table 4.

Indicators 1, 5, 6, and 7 are identified mainly from event statistical reports. Participation instances reflect event scale, while ticket or registration-fee revenue, sponsorship revenue, and advertising revenue record receipts related to delivery and commercial exploitation. When revenue is aggregated, allocated, or estimated from general information, it must be reported in accordance with the nature of the data and not automatically treated as independently verified accounts for each organizer.

Indicators 2, 3, 4, and 9 are derived from participant surveys. Information collected includes residence, length of stay, accompanying persons, and event-related expenditure. Although presented as proportions or averages, they remain input indicators because they arise directly from raw survey data and are not yet extrapolated impact estimates.

For pooled analysis of the seven events, post-stratification weights were used primarily for survey-based proportions and means. Extrapolated totals were calculated using the stated event-scale parameters and formulas. Weights were not applied to participation instances, revenue recorded in statistical reports, or official GRDP data, and they do not transform the convenience sample into a probability sample.

Indicators 8, 10, 11, 12, and 13 are intermediate aggregation or extrapolation indicators. Total direct revenue is formed from the three identified revenue sources; total event-related expenditure by participants and accompanying persons is estimated from survey data combined with the scale of each event; and total direct cash flow aggregates direct revenue and expenditure after checking for double counting. These indicators link original data with estimated impact results and must not be treated as independent revenue or expenditure amounts that can be added again to their components.

Table 4: Content, data source, level, and method of identifying indicators for assessing the economic impact of sports events on economic development in HCMC

No.	Indicator constructed for this study from the relevant data sources and methodological principles stated in the article	Indicator level	Data source	Content and method of identification
1	Number of sports-event participation instances.	Input.	Viral Sport statistical reports on the events studied.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.
2	Proportion of participants residing outside HCMC.	Input.	Sports-event participant survey questionnaire.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.
3	Average length of stay of participants.	Input.	Sports-event participant survey questionnaire.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.
4	Average accompanying persons per participation instance.	Input.	Sports-event participant survey questionnaire.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.
5	Ticket or registration-fee revenue.	Input.	Viral Sport statistical reports on the events studied.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.
6	Sponsorship revenue.	Input.	Viral Sport statistical reports on the events studied.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.
7	Advertising revenue.	Input.	Viral Sport statistical reports on the events studied.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.
8	Total event-related direct revenue.	Intermediate.	Aggregated from indicators 5, 6, and 7.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.
9	Average event-related expenditure of participants.	Input.	Sports-event participant survey questionnaire.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.
10	Total event-related expenditure of participants.	Intermediate.	Combined participant-survey data and participation instances recorded for each event.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.
11	Total event-related expenditure of accompanying persons.	Intermediate.	Participant survey questionnaire and event participation reports.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.
12	Total event-related expenditure of participants and accompanying persons.	Intermediate.	Aggregated from indicators 10 and 11.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.
13	Total event-related direct cash flow.	Intermediate.	Aggregated from indicators 8 and 12.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.

(Contd...)

Table 4: (Continued)

No.	Indicator constructed for this study from the relevant data sources and methodological principles stated in the article	Indicator level	Data source	Content and method of identification
14	Total estimated impact of sports events on economic development in HCMC.	Estimated output.	Indicator constructed for this study from the relevant data sources and methodological principles stated in the article.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.
15	Ratio of total estimated impact to HCMC GRDP.	Reference output.	Indicator constructed for this study from the relevant data sources and methodological principles stated in the article.	Defined from the stated data source in accordance with the measurement and extrapolation procedure described in the text.

Source: Developed by the authors. HCMC: Ho Chi Minh City, GRDP: Gross regional domestic product

Indicators 14 and 15 are outputs. Total estimated impact is determined under the chosen multiplier scenario, while the ratio to HCMC GRDP is a relative-scale reference. Neither directly represents profit, value added, or the events' actual contribution to the City's GRDP.

Several quantities not selected as official indicators may still be used as supplementary analytical information. Average event-related expenditure of non-HCMC residents characterizes participant groups; expenditure by service group supports analysis of spending allocation; and estimated ripple impact is derived from applying the multiplier and is not an independently measured impact amount. Their use clarifies how official indicators are determined without changing the selected 15-indicator system.

Indicators are identified using consistent rules on geographical scope, study period, units of measurement, survey respondents, and data sources. Tickets or registration fees recorded in revenue are not included again in participant expenditure; shared expenditures are reviewed to limit double counting. Extrapolated and estimated results are interpreted only for the seven events studied and under the assumptions of the selected method.

The 15 indicators therefore follow a sequence from input data to intermediate indicators and outputs: Eight input indicators, five intermediate aggregation or extrapolation indicators, and two output indicators. This classification supports subsequent presentation of survey results, revenue identification, expenditure extrapolation, and estimation of sports events' economic impact in HCMC.

CONCLUSION

From 22 preliminary indicators and consultation with 30 experts, the study selected 15 indicators for assessing the economic impact of sports events under HCMC conditions. The system covers participant scale and characteristics, direct revenue, event-related expenditure, and aggregated and estimated impact results. Crucially, it differentiates inputs, aggregated/extrapolated results, and estimated outputs, thereby limiting confusion between event-related cash flow and profit, value added, or contribution to GRDP.

The system can serve as a minimum monitoring and reporting framework for running and marathon events in HCMC and as a reference for adaptation to other sport-event types. However, the findings apply only to the event type and data conditions studied. Wider application requires adjustment for the characteristics of participants and spectators, revenue structure, and data-collection capacity of each event type.

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Research Article

The technical trap: Analyzing the disconnect between command-style coaching and game intelligence in Jaffna district basketball

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ABSTRACT

Background: Traditional athletic development models often rely on linear training designs and command-oriented instructions, which can isolate technical skill execution from dynamic game contexts. While these approaches establish baseline mechanics, their effectiveness in developing autonomous on-court decision-making remains a subject of debate within ecological dynamics frameworks. **Objectives:** This study empirically investigated the multi-dimensional sports ecosystem of competitive young adult male basketball players in the Jaffna District to evaluate the relationships between cognitive, psychological, environmental, and coaching factors, and their combined impact on actual game intelligence. **Methodology:** A quantitative, correlational design was utilized to assess organized club basketball players trained under traditional pedagogical frameworks. Bivariate correlation analyses mapped the statistical relationships between athlete internal traits, available physical infrastructure, prevailing coaching methodologies, and live-game processing capabilities. **Results:** The data revealed robust internal and structural networks, featuring strong positive correlations between cognitive and psychological factors ($r = 0.612$, $P < 0.001$) and a dense institutional link between coaching practices and environmental frameworks ($r = 0.586$, $P < 0.001$). However, Game Intelligence was statistically isolated, showing weak, non-significant correlations with baseline cognitive factors ($r = 0.103$, $P = 0.317$) and environmental factors ($r = 0.152$, $P = 0.140$). Furthermore, a negative directional trend emerged between game intelligence and psychological factors ($r = -0.149$, $P = 0.146$), indicating an underlying systemic friction. **Conclusion:** Static intellectual capacities and rigid, environment-bound coaching methods do not automatically translate into real-time decision-making on the court. The inverse relationship between psychological comfort and tactical expression suggests that hyper-structured, command-style systems penalize athlete improvisation, inducing performance anxiety. To foster adaptive game intelligence and divergent tactical creativity, regional training programs must shift toward modern ecological dynamics and constraint-led training designs, such as small-sided games.

Keywords: Basketball ecosystem, Command pedagogy, Ecological dynamics, Game intelligence, Performance anxiety, Tactical creativity

INTRODUCTION

Modern sports science increasingly recognizes that athletic excellence requires a clear distinction between raw mechanical execution and on-court decision-making capabilities (Correia *et al.*, 2018). In developing basketball circuits, traditional training paradigms rely heavily on linear training models and command-oriented coaching styles (Chow *et al.*, 2007). These practices emphasize explicit instruction and closed, repetitive

drill structures – such as undefended three-man weaves or running plays against static air – that lack contextual realism (Renshaw *et al.*, 2019). While traditional methodology builds baseline muscle memory and predictable physical execution, it isolates a player's cognitive processing and anticipatory judgment from actual in-game contextual cues (Broadbent *et al.*, 2015). Consequently, a critical divergence arises between institutionalized athletic preparation and the development of independent, real-time decision-making.

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Ecological dynamics theories assert that static, abstract, or academic cognitive capacities do not automatically transfer into high-speed, dynamic visual-spatial execution on the

court (Araújo *et al.*, 2006). True game intelligence is highly contextual, relying on specialized visual search paths and real-time cue extraction rather than raw intellectual reasoning (Memmert, 2015). Furthermore, hyper-structured, coach-dominated environments can penalize independent tactical choices, inducing performance anxiety and cognitive dissonance when players attempt to improvise (Memmert, 2011).

To understand the systemic factors limiting player development, this study examines the multi-dimensional ecosystem of basketball performance. It evaluates the relationships among five core variables: Cognitive factors, psychological factors, environmental factors, coaching factors, and game intelligence. The objective of this paper is to empirically analyze how structural, environmental, and internal psychological traits correlate with actual on-court Game Intelligence, identifying the pedagogical bottlenecks that inhibit adaptive, independent playmaking.

METHODOLOGY

Research Design

This study employs a quantitative, correlational research design to examine the interconnected ecosystem of competitive basketball performance. By assessing the statistical relationships among internal player traits, structural ecosystems, and tactical performance, this design evaluates how institutionalized training infrastructures impact the development of on-court decision-making.

Participants

The target population for this investigation consists of young adult male basketball players competing within organized club frameworks in the Jaffna District. Participants were selected from regional clubs characterized by traditional, command-style pedagogical training backgrounds.

Variables and Measurement

The study evaluates five primary operational dimensions:

- **Cognitive factors:** Evaluates baseline abstract reasoning, spatial awareness, and static cognitive capabilities detached from live-game constraints
- **Psychological factors:** Measures competitive resilience, self-regulation, confidence, and the management of performance anxiety under stress
- **Environmental factors:** Quantifies the immediate physical and organizational ecosystem, including facility access, equipment standards, and structural club support
- **Coaching factors:** Assesses prevailing pedagogical methodologies, tracking the use of explicit, command-style instructions versus open-ended training designs
- **Game intelligence:** Measures context-specific field vision, dynamic visual scanning, real-time cue extraction, and situational improvisation on the court.

Statistical Analysis

Data were analyzed using regular bivariate statistical treatments to compute a comprehensive correlation matrix. Pearson correlation coefficients (r) were calculated to determine the strength and direction of the relationships between the five variables, with statistical significance (p) evaluated against standard alpha thresholds.

Specifically, the analysis targeted:

1. Covariation within the internal and structural baseline (Cognitive, psychological, and environmental interactions) (Table 1)
2. The coaching-environmental axis to evaluate institutional dependency
3. The statistical correlation or isolation of game intelligence relative to static cognition, rigid coaching metrics, and directional psychological trends ($r = -0.149$, $P = 0.146$).

Key Findings and Data Interpretation

The interconnected baseline

The data shows highly significant, positive relationships among a player's underlying internal traits and their immediate ecosystem:

- **Cognitive and psychological covariation:** There is a strong positive correlation ($r = 0.612$, $P < 0.001$) between cognitive and psychological factors. This shows that a player's baseline abstract and spatial reasoning is closely linked to their psychological resilience, confidence, and anxiety management under stress.
- **Environmental buffering:** Environmental factors (facility access, equipment standards, and structural support) correlate significantly with both psychological resilience ($r = 0.411$, $P < 0.001$) and cognitive performance ($r = 0.316$, $P = 0.002$).

The coaching-environmental axis

A strong, highly significant correlation exists between coaching factors and environmental factors ($r = 0.586$, $P < 0.001$). This demonstrates that in the surveyed ecosystem, coaching quality is heavily dependent on or paired with the quality of physical infrastructure and organizational framework available in the district. Better environments fundamentally enable more structured coaching interventions. Furthermore, coaching factors show a modest but significant positive link to player psychological outcomes ($r = 0.251$, $P = 0.014$).

The "Game Intelligence" paradox

The most critical revelation in the data is the statistical isolation of game intelligence:

- **Weak/insignificant links:** Game intelligence does not show a statistically significant relationship with cognitive factors ($r = 0.103$, $P = 0.317$) or environmental factors ($r = 0.152$, $P = 0.140$).

Table 1: Correlation matrix among cognitive, psychological, environmental, coaching, and game intelligence variables

Variables	1. Cognitive	2. Psychological	3. Environmental	4. Coaching	5. Game intelligence
1. Cognitive factors	1.000	0.612**	0.316**	0.163	0.103
2. Psychological factors	0.612**	1.000	0.411**	0.251*	-0.149
3. Environmental factors	0.316**	0.411**	1.000	0.586**	0.152
4. Coaching factors	0.163	0.251*	0.586**	1.000	—
5. Game intelligence	0.103	-0.149	0.152	—	1.000

*Correlation is significant at the $P < 0.05$ level. Correlation is significant at the $P < 0.01$ level.

- Negative psychological trend: An inverse, statistically non-significant trend emerged between game intelligence and psychological factors ($r = -0.149$, $P = 0.146$).

Key takeaways

1. Game intelligence is distinct from static classroom cognition: The lack of a meaningful correlation between cognitive factors and game intelligence ($r = 0.103$) proves that high static academic or abstract intelligence does not automatically translate into on-court spatial awareness or rapid tactical execution. On-court intelligence is context-specific; it must be built through active, game-representative situations rather than passive learning.
2. The structural bottleneck of rigid coaching: While coaching links tightly to structural and environmental factors ($r = 0.586$), it fails to establish a meaningful positive correlation with game intelligence. This indicates that current coaching methodologies are over-indexed on rigid, predictable, and technical drill sets (command-style pedagogy). This approach improves basic mechanics but fails to develop a player's independent, dynamic reading of the game.
3. The psychological cost of hyper-structured play: The negative directional trend between psychological factors and game intelligence ($r = -0.149$) highlights a crucial systemic issue. In highly disciplined, rigid play systems, players who try to develop higher game intelligence or execute creative, non-standard plays often face fear of making mistakes or strict coaching pushback. This friction introduces performance anxiety and reduces confidence, explaining why higher expressive tactical processing correlates with lower psychological comfort in a strict system.

DISCUSSION

The lopsided development of game intelligence among young adult players in Jaffna stems directly from historical and pedagogical factors in the region's sports system:

Linear Training Models and Command Styles

Coaching practices across most clubs in the Jaffna District lean heavily toward a command-oriented style. Workouts rely on

explicit instruction and closed, repetitive drill structures (such as undefended three-man weaves or running plays against static air). While this methodology builds baseline muscle memory and predictable physical execution, it largely isolates cognitive processing from actual contextual cues. On court, players struggle to scan the environment efficiently, leaving them vulnerable to unexpected defensive adjustments.

The Constraints-Led Approach (CLA) as a Strategic Remedy

To bridge this gap in tactical creativity, regional training programs should shift toward a CLA. By introducing small-sided games (SSGs) – such as 3×3 matchups on modified half-courts with specific rule boundaries (e.g., no dribbling allowed, or scoring restricted to paint touches) – coaches can force players to actively read and exploit spatial layout variations. This model demonstrates that game intelligence scales directly with a player's continuous exposure to changing visual cues and changing spatial geometry over time, rather than isolated mechanical repetitions.

The Classroom-Court Cognitive Disconnect

A foundational finding of this study is the weak, non-significant correlation between baseline Cognitive Factors and Game Intelligence ($r = 0.103$, $P = 0.317$). This empirical result directly confirms ecological dynamics theories, which state that static, abstract, or academic cognitive capacities do not automatically transfer into high-speed, dynamic visual-spatial execution on the court (Araújo *et al.*, 2006).

Cognitive factors share a strong, highly significant relationship with general psychological factors ($r = 0.612$, $P < 0.001$), indicating that higher baseline reasoning helps players manage stress and self-regulate. However, it does not provide the sport-specific “field vision” required to read collapsing defenses. Game intelligence is highly contextual; it relies on specialized visual search paths and real-time cue extraction rather than raw, isolated intellectual processing (Memmert, 2015).

The Technical Trap of Rigid Coaching

The data reveals a dense, highly significant correlation between environmental factors and coaching factors ($r = 0.586$, $P < 0.001$). This strong link indicates that coaching practices in

this region are heavily bound to and dictated by the available structural environment, infrastructure, and institutionalized club frameworks.

However, despite coaching factors showing a positive correlation with player psychological outcomes ($r = 0.251$, $P = 0.014$), coaching metrics fail to show any meaningful positive correlation with game intelligence. This statistical disconnect strongly points to a systematic over-reliance on command-style pedagogy and highly predictable, linear drill setups. Traditional training regimens successfully build mechanical technical mastery and physical discipline, but they strip away the open-ended problem-solving environments necessary to develop tactical intelligence (Passos *et al.*, 2016). Players become highly disciplined executors of scripted instructions, but struggle when forced to independently navigate chaotic, unscripted game situations.

The Psychological Penalty of On-Court Improvisation

Perhaps the most critical revelation in the data is the negative directional trend between Game Intelligence and Psychological Factors ($r = -0.149$, $P = 0.146$). While not crossing the threshold for strict statistical significance, this inverse relationship uncovers an underlying systemic friction.

In a hyper-structured, coach-dominated playing environment, players who possess or try to exert independent game intelligence and creative improvisation often experience cognitive dissonance and performance anxiety. When a player attempts a high-risk, creative play that deviates from the coach's rigid script, any resulting error is frequently met with immediate benching or reprimand. This dynamic creates a fear-based playing climate where trying to develop divergent tactical creativity actively compromises a player's immediate psychological comfort and confidence (Memmert, 2011). Consequently, players suppress their natural playmaking instincts in favor of safe, risk-averse, and low-efficiency options.

CONCLUSION AND RECOMMENDATIONS

Young adult male basketball players in the Jaffna District show strong structural discipline and clear competency in executing convergent tactical sets. However, their overall game intelligence is bottlenecked by low scores in divergent tactical creativity and situational improvisation. To elevate regional basketball standards to a truly competitive national level, the following interventions are recommended:

1. Coach education overhaul: Transition provincial coaching certification workshops away from purely technical instruction and toward modern ecological dynamics and game-representative training designs.
2. Implementation of SSGs: Replace traditional, predictable drill configurations with representative SSGs to actively build real-time spatial reading and adaptive decision-making under defensive pressure.

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Research Article

Comparison of agility among softball players and cricketers of Telangana – A study

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ABSTRACT

Agility defined as the ability to rapidly change direction while maintaining control and speed is a fundamental skill required in almost all sports. It involves quick reflexes, coordination, dynamic stability, and explosive movements. In cricket, agility is crucial for fielders who need to react swiftly to catches, run between wickets, or change direction quickly while fielding. The purpose of the present study was to find out the agility among softball players and cricketers of Telangana. The sample for the present study consists of 120 male softball players and 120 male cricketers of Telangana between the age group of 18 and 25 years. The agility *t*-test is used to assess the agility among male softball players and cricketers. The present study demonstrated that cricketers had significantly better agility than softball players ($t = -10.705, P < 0.001$). Agility involves the ability to rapidly change direction while maintaining balance and control. Cricket requires players to frequently accelerate, decelerate, dive, turn, and change direction during batting and fielding, thereby improving agility through regular sport-specific practice.

Keywords: Agility, Batting, Cricketers, Fielding, Softball, etc.

INTRODUCTION

Agility, defined as the ability to rapidly change direction while maintaining control and speed, is a fundamental skill required in almost all sports. It involves quick reflexes, coordination, dynamic stability, and explosive movements. In cricket, agility is crucial for fielders who need to react swiftly to catches, run between wickets, or change direction quickly while fielding. Similarly, agility is vital in volleyball, where players must dive, move laterally, and transition rapidly from defensive to offensive positions. However, the type of agility required in these two sports may differ due to the varying nature of gameplay, playing surfaces, and movement patterns.

Cricket is a bat-and-ball game played between two teams of 11 players each on a field at the center of which is a rectangular 22-yard long pitch. The game is played by 120 million players

in many countries, making it the world's second most popular sport. Each team takes its turn to bat, attempting to score runs, while the other team fields. Each turn is known as an innings. The bowler delivers the ball to the batsman who attempts to hit the ball with his bat away from the fielders so he can run to the other end of the pitch and score a run. Each batsman continues batting until he is out. The batting team continues batting until 10 batsmen are out, or a specified number of over's of six balls have been bowled, at which point the teams switch roles and the fielding team comes in to bat.

Softball is a variant of baseball played with a larger ball on a smaller field. It was invented in 1887 in Chicago as an indoor game. It was at various times called indoor baseball, mush ball, playground, soft bund ball, and kitten ball, and, because it was also played by women, ladies' baseball. The name softball was given to the game in 1926. A tournament held in 1933 at the Fairs purred interest in the game.

Softball is a sport that requires both muscular strength and endurance, and for this reason when training with weights you

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need to concentrate on developing strong muscles with high endurance capabilities. Speed is a key component of physical fitness which is very important for softball players for giving the high level of performance in competition. Speed is the performance pre-requisite to do motor actions under given conditions in minimum of time. Speed is the ability to move all or part of the body quickly, that is, speed is the quickness of movement of a limb, whether this is the legs of a runner or the arm of the shot putter. Speed means relative rapidity in moving, going, etc., rate of motion or progress: Speed is an integral part of every sport and can be expressed as any one of, or combination of, the following: Maximum speed, elastic strength, and speed endurance, combination of reflexes and stamina. Speed training is something that should be done throughout the year – unless there are some points of the season where you don't have to move fast – so little and often is better. Constantly reinforce the quality of execution of your speed.

Shinde *et al.*^[1] comparison of agility and balance between cricket players and volleyball players. This study compares agility and balance between cricket and volleyball players, analyzing how these attributes vary due to the specific demands of each sport. The research involved 30 male athletes from both sports, aged 18–30 years, who underwent the Illinois agility test and stork balance stand test. The results showed no significant difference in agility and balance between the two groups, contradicting the initial hypothesis. The findings suggest that despite differing sport-specific training, cricket and volleyball players exhibit comparable levels of agility and balance. The study's results have implications for coaches and trainers in designing sport-specific training programs, highlighting the need for tailored approaches to enhance agility and balance in athlete.

Jyothi^[2] comparison of speed among cricketers and softball players of Andhra University, Visakhapatnam, Andhra Pradesh. The purpose of the study is to find out speed among male cricketers and male softball players of Andhra University, Visakhapatnam, A.P. the sample for the study consists of 30 men cricketers and 30 men softball players those who are studying in different Colleges of Andhra University, Visakhapatnam, Andhra Pradesh, between the age group of 18 and 25 years were selected for the study. 30 m run test used for the study. The mean values of cricketers are 4.87 and softball players mean values is 4.23. Based on mean values, softball players were performing better than cricketers in speed. In conclusion, for sprint speed and quick, short-distance agility, softball players often outperform cricket players, but cricketers exhibit superior power in specific, repetitive high-velocity actions like fast bowling.

Deshmukh^[3] comparative study of fitness components of cricket and softball players. The study was conducted to compare the agility and flexibility variables of cricket and softball male players of Takshashila Mahavidyalaya, Amravati,

(MS). A total of 40 players, comparing 20 cricket players and 20 softball players of Takshashila Mahavidyalaya, Amravati, (MS) which were randomly selected for the study. The subjects were selected by using simple random sampling. The age of the subjects ranged between 18 and 25 years was selected to analyzed flexibility and agility of the players of both the games. Agility and flexibility using standard tests, namely, 40 yard shuttle run and goniometer were used respectively for the study. The analysis of data using “t”-test for finding the significance difference of agility and trunk flexibility in-between cricket and softball male players. On the basis of our study, it is concluded that the agility and trunk flexibility of cricket players has significant difference. The result shows that the softball players had more agility than cricket players and cricket players had more flexibility than softball players.

Kakran and Arora^[4] studied the selected physical variables between cricket and softball players. A total of 60 male subjects (30 each in softball and cricket) age ranges from 18 to 26 were selected purposively for the study from different region of Madhya Pradesh who have participated in inter-university tournaments. The data were collected for different physical variables, that is, back strength, hand grip (right and left), and balance (dynamic and static). For the analysis of data, independent t-test has been employed. The level of significance was set at 0.05. The significant difference was found between cricket and softball players on dynamic balance. Whereas, insignificant differences were found for other physical variables, that is, back strength, static balance, and handgrip strength (right and left) among softball and cricket player.

Purpose of the Study

The purpose of the present study was to find out the agility among softball players and cricketers of Telangana.

METHODOLOGY

The purpose of the present study was to find out the agility among softball players and cricketers of Telangana. The sample for the present study consists of 120 male softball players and 120 male cricketers of Telangana between the age group of 18 and 25 years. The agility *t*-test is used to assess the agility among male softball players and cricketers.

RESULTS AND DISCUSSION

The comparison of Agility between Cricketers and Softball Players of Telangana

Table 1.

Results of Agility

Table 1 shows the comparison of agility between cricketers and softball players. The mean agility score of cricketers was

Table 1: Comparison of agility between cricketers and softball players

Group	<i>n</i>	Mean	Standard deviation	<i>t</i> -value	<i>P</i> -value
Cricketers	120	9.01	0.30	-10.705	<0.001**
Softball players	120	9.53	0.44		

9.01 ± 0.30 s, whereas softball players recorded 9.53 ± 0.44 s. The obtained *t*-value of -10.705 was statistically significant ($P < 0.001$). Hence, a significant difference existed between cricketers and softball players in agility. Since a lower agility test time indicates better agility performance, the findings indicate that cricketers possessed significantly superior agility compared to softball players. The present study demonstrated that cricketers had significantly better agility than softball players ($t = -10.705$, $P < 0.001$).

CONCLUSION

Agility involves the ability to rapidly change direction while maintaining balance and control. Cricket requires players to frequently accelerate, decelerate, dive, turn, and change

direction during batting and fielding, thereby improving agility through regular sport-specific practice.

RECOMMENDATIONS

1. Similar studies can be conducted on other events and among females
2. This study also helps the physical educators and coaches to improve their training regime to excel in softball and cricketers.

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Research Article

Effect of hill running and continuous running for the development of speed among long distance runners of Osmania University, Hyderabad

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ABSTRACT

The purpose of the study is to find out the effect of hill running and continuous running for the development of speed among long distance runners of Osmania University, Hyderabad. The sample for the present study consists of 45 male long distance runners of Osmania University between the age group of 18–25 years out of which 15 are experimental group (hill running), 15 are the experimental group (continuous running), and 15 are controlled group. Hill running training, such as short hills, medium hills, long hills, and mixed hills running, were given to experimental group (hill running) on alternate days along with the general training of long distance running, continuous running, such as short continuous runs, middle continuous running, long continuous running, fartlek running, was given to experimental group (continuous training) on alternate days for 12 weeks along with general training of long distance running and control group was given the general training of long distance running. Pre-test and post-test were conducted for 50 M run to assess the speed of all groups. It is concluded that due to hill running and continuous running methods, there is an improvement of speed among experimental groups. It is recommended that the coaches must include the hill running and continuous running programs among long distance athletes for development of speed.

Keywords: Continuous running, Hill running, Long distance runners, Speed, etc.

INTRODUCTION

Endurance performances are of different nature indifferent sports. Endurance activities have been found to be of high value for maintenance of good organic health, for increasing the general resistance against infection and for cure and treatment of various diseases and metabolic disorder.

Hill training offers the following benefits:

- Helps develop power and muscle elasticity
- Improves stride frequency and length
- Develops co-ordination, encouraging the proper use of arm action during the driving phase and feet in support phase
- Develops control and stabilization as well as improved speed (down-hill running)
- Promotes strength endurance (SE)

- Develop maximum speed and strength (short hills)
- Improves lactate tolerance (mixed hills).

Continuous Training

Running without rest continuous training may be used to develop general endurance specific endurance and recovery. It usually takes place away from the track and provides a variety of pace, location and running surface in the athletes, training. Runs may be short, medium, or long but it should be remembered that long and short are relative to the stage of development of the athlete and their fitness levels. The same distance might be a “short” run for one athlete and a “long” run for another athlete. The other type of continuous training which may be used throughout the year is “Fartlek” training, where the athlete “plays” with a variety of running speeds or rhythms.

Continuous training is a form of endurance training, which existed through a number of years in one form or another with interval training short to modern periods of work are alternated with short to moderate periods of rest or reduced

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activity. This concept has a firm foundation in the physiological principles. Researches have revealed that athletes can execute a demonstrably greater volume of work by breaking the total work into short, intense bouts with rest or reduced activity, and interval interspersed between consecutive work bouts. The interval of work and rest are usually equal and can vary from several seconds to 5 min or more. The vocabulary of interval training includes the terms, set, repetition, training time, training distance, and frequency in addition to the work interval and the rest, recovery, or relief interval. Continuous method is perhaps the most versatile method for improving endurance of various types. Continuous method of exercise is done at relatively higher intensity with intervals of incomplete recovery. Interval method is based on the following principles; work should be done with sufficient speed and duration that the heart rate rises up to 180 beats/min. After this, there should be a recovery period and when the heart rate comes down to 120–130 beats/min the work should be begun again. Therefore, the training load in interval method can be controlled by repeatedly checking the heart rate. The effect of interval and continuous method is determined by the variables of interval method such as speed of the activity and duration of the activity.

Alemu (2025) *et al.*, this study investigated the effects of three uphill gradients; shallow hill group (SHG ~ 2.5%), intermediate hill group (IHG ~ 5.1%), and steeper hill group (STHG ~ 7.6%) on maximal velocity (Vmax), 800 m time trial (TT), and SE performance in middle-distance runners. Forty moderately trained athletes (aged 16–20) were randomly assigned to SHG, IHG, STHG, or control groups (CGs) ($n = 10$ each). Over 8 weeks, participants completed gradient-specific training. Vmax (30 m sprint), TT (800 m), and SE (1-min burpees) were assessed pre- and post-intervention. Two-way repeated-measures analysis of variance revealed significant main effects on Vmax ($F(3,36) = 2.87, P = 0.049, \eta^2 P2 = 0.20$), TT ($F(3,36) = 7.60, P < 0.001, \eta^2 P2 = 0.39$), and SE ($F(3,36) = 5.19, P = .004, \eta^2 P2 = 0.30$). *Post hoc* analysis showed STHG significantly outperformed CG in Vmax ($m\Delta = 0.93, P = 0.040$), TT ($m\Delta = -0.29, P = 0.001$), and SE ($m\Delta = 3.90, P = 0.007$). IHG also improved TT versus CG ($m\Delta = -0.25, P = 0.007$). The finding revealed that, uphill training, particularly steeper gradients, significantly enhances speed, endurance, and running performances. Therefore, coaches and athletes should customize training programs using uphill while carefully matching the strengths and weaknesses of the athlete and the demands of the event.

Kumar (2023) effect of hill running and circuit training for development of aerobic fitness among marathon runners. Marathon is long distance running of 42.195 KM on road. Hill running and circuit training are important training methods to develop aerobic fitness among marathon runners. The purpose of the study was to find aerobic fitness among marathon runners of Telangana State in India. Methods: Male marathon runners of Telangana State in India who participated in different Marathon

events aged 25–30 years were divided into three groups of fifteen each, experimental group of hill running ($n = 15$), circuit training group ($n = 15$), and a CG ($n = 15$). Both experimental groups trained on alternate days for 12 weeks 1 h/session and CG underwent general training of marathon on alternate days. Pre-test and post-test were conducted among three groups for 12 min run cooper test to find the maximum distance covered in 12 min. Results: The results of the study represented by mean and standard language (SD) showed in pre- and post-test a reading of 2391.83 ± 102.57 and 2678.50 ± 109.11 in hill training group with an F ratio of 129.92 at 0.000 level of confidence, whereas circuit training group with mean and SD of 2365.00 ± 90.45 in pre and 2518.30 ± 79.78 in the post with F ratio of 129.92 significant at 0.000 level of confidence indicating that hill training group had noteworthy improvements in performance than circuit training and CGs. Circuit training group also showed improvements. It is concluded that hill running is the good training method to develop the aerobic fitness.

Kumar (2018) effect of hill training and fartlek training for development of aerobic fitness among middle and long-distance runners of Hyderabad district in India aerobic fitness is vital for middle and long-distance runners. Aerobic fitness is of special importance at the beginning of the preparatory period. The objective of this study is to determine the effects of hill training and fartlek training for development of aerobic fitness among the middle and long-distance runners. The sample for the study consists of 45 middle- and long-distance runners between the age group of 18 and 20 years those who have participated in many middle- and long-distance events since last 3 years. The selected subjects were randomly divided into three equal groups of 15 each. Group I is experimental hill training group, Group II is experimental fartlek training group, and Group III is CG. The experimental groups were given training alternate days for 12 weeks in addition to their normal practice on other days. The CG was given routine training. The data were collected in pre-test and post-test for all groups using the 12 min run cooper test. The collected data were analyzed statistically using analysis of covariance. The results of the study show that due to hill training and fartlek training, there is a significant development of aerobic fitness among experimental groups. It is concluded that hill running and fartlek running is beneficial to middle- and long-distance runners to stronger the lower body muscles, resistance to fatigue, etc. It helps for development of aerobic fitness.

METHODOLOGY

The sample for the present study consists of 45 male long distance runners of Osmania University between the age group of 18 and 25 years out of which 15 are experimental group (hill running), 15 are the experimental group (continuous running), and 15 are controlled group. Hill running training such as short hills, medium hills, long hills, and mixed hills running were given to experimental group (hill running) on alternate

Table 1: Mean, standard deviations, and one-way analysis of covariance in 50 m run of continuous training, hill running training, and CG among long-distance runners of Osmania University

Test	Continuous training	Hill running training	CG	S O V	Sum of squares	Df	M.S.	F-ratio	P-value
Pre-test									
Mean	7.16	7.04	7.17	B	0.297	2	0.148	1.797	0.172
SD	0.307	0.266	0.286	W	7.179	87	0.083		
Post-test									
Mean	6.95	6.71	7.22	B	3.907	2	1.953	24.43*	0.000
SD	0.282	0.286	0.279	W	6.954	87	0.080		
Adjusted mean	6.91	6.78	7.18	B	2.338	2	1.169	224.27*	0.000
				W	0.448	86	0.005		

*Significant ($P < 0.05$). SD: Standard deviation, CG: Control group

Table 2: Sheffe's *post hoc* test of continuous training, hill running training, and CG among long distance runners of Osmania University in 50 m

Continuous training	Hill running training	CG	Mean difference	P-value
6.91	6.78		0.13*	0.000
6.91		7.18	0.27*	0.000
	6.78	7.18	0.40*	0.000

*Significant ($P < 0.05$). CG: Control group

Table 3: Comparison of statistical results among all groups of long-distance runners of Osmania university in 50 m run

Name of the group	Statistical function	50 m run		M.I
		Pre-test	Post-test	
Continuous training group	Mean	7.17	6.95	3.07
	SD	0.3	0.28	
Hill running group	Mean	7.05	6.71	4.82
	SD	0.26	0.28	
Control group	Mean	7.17	7.22	-0.7
	SD	0.28	0.27	

SD: Standard deviation

days along with the general training of long distance running, continuous running, such as short continuous runs, middle continuous running, long continuous running, and fartlek running, was given to experimental group (continuous training) on alternate days for 12 weeks along with general training of long distance running and CG was given the general training of long distance running. Pre-test and post-test were conducted for 50 M run to assess the speed of all groups.

RESULTS AND DISCUSSION

The 50 M run continuous is 7.16, hill running 7.04, and CG is 7.17 and PT mean 50 M run of continuous training group is

6.95, hill running training 6.71, and CG is 7.22. The adjusted mean of continuous training group is 6.91, hill running training group 6.78, and CG is 7.18. The sum of squares of all groups is 0.297 and 3.907 and adjust mean is 2.338. The mean squares of all groups are 0.297 and post-test is 3.907 and adjust mean 2.338.

The adjusted means of the continuous training is 6.91, circuit training is 6.78, and control group is 7.18. It shows that hill running mean of 6.78 is better than continuous training mean of 6.91 in the 50 M run.

The comparison of mean difference 50 M run in continuous training experimental group pre-test 7.17 to post-test 6.95, hill running experimental group pre-test 7.05 to post-test 6.71, and CG pre-test 7.17 to post-test 7.22. In 50 M run, the hill running group has performed better than continuous training group and CG.

CONCLUSION

The hill running group and continuous running training is suitable training methods useful in the long distance running for the development of physical abilities such as speed, strength, endurance, flexibility, and agility.

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Research Article

Effect of 12 weeks core strength training and hill running on the development of maximal-effort anaerobic capacity and leg power assessment among sprinters of Osmania University

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ABSTRACT

The purpose of the present study was to determine the effect of core strength training and hill running on the development of maximal effort and aerobic capacity, and leg power assessment among sprinters of Osmania University. To achieve the purpose of the study, the male sprinters were randomly selected from the different colleges of Osmania University between the age group was 18 and 25 years. The selected subjects were divided into three groups of 15 each, namely, two experimental groups and one control group. Out of a total of 45 subjects, 15 underwent core strength training on alternate days; another set of 15 underwent hill running, whereas the control group did not receive any specific training. The duration of the training period was 12 weeks at a rate of 3 sessions/week. A 300 m run test was used in the study. The results of the study reveal that there is a significant improvement in the core strength training group and hill running group when compared to the control group.

Keywords: Aerobic capacity, Core strength training, Hill running, Leg power

INTRODUCTION

For the sprinters, the first and most important aspect of speed is posture. Sprinting posture is going to be much different than acceleration. During sprinting, we are looking to be much more erect through our trunk; we want our head level, hips high, foot contact slightly ahead of our center of mass, and a large range of motion through our limbs. Obtaining this upright, tall position allows for better freedom of movement, elastic energy production, maximal power production, better relaxation, and efficiency.

Phases of Sprinting

100 m is divided into a few phases as follows:

- Starting block (set up)
- Starting block clearance (0–5 m)
- Drive phase/acceleration (5–15 m)
- Transition (15–30 m)
- Maximum velocity (30–60 m)
- Speed maintenance (60–100 m).

There are several phases in sprinting; for instance, the acceleration phase is the most important phase in a race. During this phase, after the sprinter has left the starting blocks, the athlete increases the length of their stride and decreases the number of strides taken per second. Male sprinters usually have a stride rate of 4.6 strides/s, whereas female athletes have slightly less with 4.8 strides/s. Elite sprinters reach their highest speed at around the 60–70 m distance in a 100-m race for men. Professional women sprinters reach their top speeds at around the 50–60 m distance. Top runners usually cover 20–30 m at top speed.

Ramu and Kumar (2025) examined the effect of 12 weeks of circuit training and plyometric training on leg muscle power among sprinters of Telangana state. The purpose of the present study was to determine the effect of circuit training and plyometric training on leg muscle power among sprinters of Telangana state. To achieve the purpose of the study, the male sprinters were randomly selected from Telangana state, and their age group was 18–25 years. The selected subjects were divided into three groups of 15 each, namely, two experimental groups and one control group. Out of a total of 45 subjects, 15 underwent circuit training on alternate days,

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another set of 15 underwent plyometric training, whereas the control group did not receive any specific training. The duration of the training period was 12 weeks at a rate of 3 sessions/week. Vertical jump tests were used in the study to assess leg explosive power. The results of the study reveal that there is a significant improvement in the circuit training group and plyometric training group when compared to the control group.

Kumar and Zemkova (2022) studied the effect of 12-week core strengthening and weight training on muscle strength, endurance, and flexibility in school-aged athletes. Ninety male athletes at the age of 12 were randomly divided into three equal groups (30 in each). Group 1 underwent core strengthening training, Group 2 underwent weight training, and Group 3 was the control. The training was for 12 weeks, with 3 sessions/week (1 h/session). Before and after the training, abdominal strength, endurance, and flexibility were evaluated using the sit-ups test, the Cooper 12 min run test, and the sit-and-reach test. The analysis of variance was used to analyze pre- and post-intervention data. The results showed that both the core strength training group and the weight training group significantly ($P = 0.00$) improved in abdominal strength, represented by the number of sit-ups (from 18.70 ± 3.20 to 22.21 ± 3.50 and from 17.60 ± 3.29 to 21.60 ± 3.63 , respectively); endurance, represented by distance covered in 12 min (from 1817 ± 185.78 m to 2008.97 ± 214.79 m and from 1806 ± 237.25 m to 2002.59 ± 83.32 m, respectively); and flexibility, represented by the sit-and-reach distance (from 23.48 ± 2.75 cm to 25.96 ± 2.38 cm and from 23.66 ± 2.92 cm to 25.86 ± 2.55 cm, respectively) when compared to the control group (from 17.20 ± 3.20 to 16.39 ± 2.69 ; from 1813 ± 224.69 m to 1778.15 ± 05.28 m; from 23.46 ± 3.06 cm to 21.76 ± 2.56 cm). More specifically, abdominal strength and endurance improved slightly more in the weight training group than in the core strength training group, while flexibility increased slightly more in the core strength training group than in the weight training group. These findings indicate that both core strengthening training and weight training are effective in improving physical fitness in school-aged athletes; however, the improvement is to differing extents regarding their endurance, flexibility, and abdominal strength.

Kumar (2020) studied the effect of plyometric and circuit training on selected physical variables among sprinters of Hyderabad District of Telangana state. To achieve this purpose, 45 sprinters in the age group of 16–20 years, who participated in the Hyderabad Open Sprints Athletics Championships at Gachibowli Stadium, Hyderabad, for the year 2019, were taken as subjects. The selected 45 subjects were divided into three equal groups of 15 each: two experimental groups and one control group, in which Group I ($n = 15$) underwent plyometric training for 3 days/

week for 12 weeks, Group II ($n = 15$) underwent circuit training for 3 days/week for 12 weeks, and Group III ($n = 15$) acted as the control group and did not participate in any training apart from their regular activities. The selected physical variables, such as abdominal strength, speed, and leg explosive power, were assessed before and after the training period. The sit-up test, 50 M dash, and standing broad jump were used to conduct the pre-test and post-test for measuring the physical variables such as abdominal strength, speed, and explosive power of legs. The results of the study showed that there was a significant difference in performance due to plyometric and circuit training when compared with the control group.

METHODOLOGY

The purpose of the present study was to determine the effect of core strength training and hill running on the development of maximal effort, aerobic capacity, and leg power assessment among sprinters of Osmania University. To achieve the purpose of the study, the male sprinters were randomly selected from the different colleges of Osmania University between the age group was 18 and 25 years. The selected subjects were divided into three groups of 15 each, namely, two experimental groups and one control group. Out of the total subjects of 45, 15 underwent core strength training on alternate days; another set of 15 underwent hill running, whereas the control group did not receive any specific training. The duration of the training period was 12 weeks at a rate of 3 sessions/week. A 300 m run test was used in the study. A 300 m test was used in the study.

Training program of core strength training for sprinters – 12 weeks

Days	AM
Monday	Warm-up, ABC Drills Plank, dead bug, bird dog, glute bridge
Wednesday	Warm-up: ABC coordination drills Side plank, reverse crunch, mountain climbers Cool down
Friday	Warm-up, activation foot drills Hanging knee, AB wheel rollout, reverse crunch, front plank Cool down

Training program of hill running for sprinters – 12 weeks

Days	AM
Tuesday	Warm- up activation, foot drills Short hill sprints
Thursday	Warm-up ABC coordination drills Medium hills
Saturday	Warm-up activation, foot drills Short hill sprints+medium hills

Table 1: *t*-test results for pre-test and post-test performance on the 300 m run test across core strength training, hill running, and control groups

Group	300 m	Mean	SD	Mean differences	<i>t</i>	Sig. (2-tailed)	T-tab value	Inference
Core strength training	Pre-test	41.933	0.6842	2.8933	18.809	0.000	2.145	S*
	Post-test	39.040	0.1404					
Hill running	Pre-test	43.333	0.7037	2.8400	23.777	0.000	2.145	S*
	Post-test	40.493	0.4166					
Control group	Pre-test	44.080	1.0150	0.0267	0.162	0.873	2.145	NS
	Post-test	44.107	1.1398					

S*: Significance, NS: Not significant, SD: Standard deviation

RESULTS AND DISCUSSION

The mean difference between the pre- and post-test results of the control and experimental groups was tested using a “*t*” ratio to determine the significance of the difference exhibited by the experimental and control groups during the training period of 12 weeks.

The pre-test mean of core strength training is 41.93, and the post-test mean is 39.04. Hence, there is an improvement from pre-test to post-test. The pre-test mean of hill running training is 43.33, and the post-test mean is 40.08. Hence, there is an improvement from pre-test to post-test. Paired *t*-test and descriptive statistics results showed pre-test heterogeneity; still, experimental groups were influenced greatly by the training periodization. A wonderful response was observed in core strength training (mean difference 2.89, *t*-value 18.8 vs. Table value 2.14) and hill running group (mean difference 2.84, *t*-value 23.77 vs. Table value 2.14) [Table 1].

Analysis of variance					
	SS	df	MD	F	sig
300 m pre-test					
Between groups	35.6	2	17.814	26.807	0.00
Within groups	27.9	42	0.665		
300 m post-test					
Between groups	204.1	2	102.099	205.227	0.00
Within groups	20.8	42	0.497		

There was a significant change noted in the pre-test obtained F-value (26.9) at $P=0.05$. The post-test F-value was 205.227 at $P=0.05$. The post-test F-value was greater than the pre-test F-value (26.8), which indicates the training interventions were found to be effective in both experimental groups.

CONCLUSION

It may be inferred that the core strength training and hill running showed significant improvement in the performance of maximal effort, aerobic capacity, and leg power. However, the control group showed no significant improvement in the performance of maximal effort, aerobic capacity, and leg power. It is concluded that the core strength training group performed better than the hill running group and the control group. Core strength training helps athletes build muscle power, aerobic capacity, and leg power.

Recommendations

Several studies on different sports disciplines proved that core strength training activates the stretch reflex mechanism in the muscle and improves leg explosive strength. In this research, the application of a core strength training hill running program increased overall maximal effort, aerobic capacity, and leg power, particularly more effectively for sprinters. Similar research work should be done on a similar set of sports to validate the results. The study also helps physical educationists and coaches understand the knowledge and performance of the sprinters.

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Research Article

Effect of yogasanas practices on the development of upper body muscle strength among middle-aged women in Peddapalli district, Telangana

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ABSTRACT

The primary objective of the study was to evaluate the effectiveness of selected yogasana practices in improving upper body muscle strength among middle-aged women in Peddapalli District, Telangana. The participants were randomly assigned into two groups: The participants were randomly assigned into two groups: an experimental group ($n = 60$), which underwent yogasana training and a control group ($n = 60$), which did not receive any intervention experimental group ($n = 60$). An experimental research design employing a pre-test and post-test control group approach was adopted for the study. A total of 120 middle-aged women between the ages of 35 and 45 years were randomly selected from yoga centers in the Peddapalli District of Telangana State. The experimental group participated in a structured yogasana training program for a duration of 6 months, with sessions conducted 6 days per week. The yogasana training schedule is designed for the experimental group to practice selected asanas for 1 h every day in the morning, 6 days a week, for up to 6 months, except on Sunday. The training time is scheduled between 6 A.M. and 7 A.M. The training protocol consisted of carefully selected asanas designed to enhance upper body muscular strength; the control group continued with their routine activities without any structured physical training during the study period. Push-up tests were used in the study. Muscular strength also demonstrated statistically significant gains ($P < 0.05$), suggesting that regular practice of yogasanas contributes to improved neuromuscular coordination and strength development. Similarly, muscular endurance showed significant enhancement ($P < 0.05$), reflecting an increased ability of muscles to sustain prolonged activity without fatigue.

Keywords: Middle-aged women, Push-ups, Upper body muscular strength, Yogasana

INTRODUCTION

Yoga is an age-old discipline that incorporates focus, deep breathing, and physical poses. Frequent yoga practice can support well-being, strength, flexibility, calmness, and endurance. Nowadays, yoga is a well-liked exercise method around the world. One out of every seven adults in the U.S. did yoga (by the 2017 National Survey).

Yoga is a spiritual discipline founded on a very subtle science that aims to bring harmony to mind and body. The union of

individual consciousness with universal consciousness is the outcome of yoga practice, according to yogic scriptures. "Yoga" is also an inner science, which is comprised of a number of methods by which human beings can achieve union between body and mind to achieve self-realization. Yoga practice (Sadhana) is meant to be free from all kinds of suffering that makes us experience a feeling of freedom in all walks of life with holistic health, happiness, and harmony.

AIMS AND IMPORTANCE OF YOGIC ASANAS

Yogic asanas improve posture, increase oxygen intake, and enhance the working of various body systems. Yogic asanas relax the mind and body and help reduce insomnia caused by

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Table 1: The mean values of pre-test and post-test on upper body muscle strength of control and experimental group

Group	Upper body muscle strength					
	Pre-test		Post-test		Adjusted post-test	
	Mean	SD	Mean	SD	Mean	SD
Control group	5.64	2.305	4.92	1.710	4.92	0.38
Experimental group	11.72	4.638	18.65	4.895	18.65	-6.35

SD: Standard deviation

mental restlessness. Yogic asanas are very much recommended for persons in a stressful working environment, persons suffering from headaches, backaches and shoulder aches, asthma, and allergies. Yogic asanas are also a cure for nervous breakdown, manic depression, and behavioral disorder. If yoga is practiced regularly, it can heal much more. Yogic asanas practice gives the capacity to face the challenges of life. Yoga increases the life force.

Nehal *et al.* studied the impact of 16 weeks of yoga training on stress in 50 women aged 25–50 with stress symptoms but no prior yoga experience. Women with major illnesses or who exercised daily were excluded. Stress was assessed using the Zung self-rated anxiety scale before and after training. Of the participants, 18 were employed, and 32 were homemakers. Anxiety scores decreased from 47.04 ± 1.99 to 32.20 ± 4.72 after yoga. The anxiety score difference was statistically significant ($P < 0.0001$). Daily yoga reduces stress and anxiety and improves psychological function in both working and non-working women, even without other exercise.

METHODOLOGY

The participants were randomly assigned into two groups: an experimental group ($n = 60$), which underwent yogasana training and a control group ($n = 60$), which did not receive any intervention experimental group ($n = 60$). An experimental research design employing a pre-test and post-test control group approach was adopted for the study. A total of 120 middle-aged women between the ages of 35 and 45 years were randomly selected from yoga centers in the Peddapalli District of Telangana State. The experimental group participated in a structured yogasana training program for a duration of 6 months, with sessions conducted 6 days per week. The yogasana training schedule is designed for the experimental group to practice selected asanas for 1 h every day in the morning, 6 days a week, for up to 6 months, except on Sunday. The training time is scheduled between 6 A.M. and 7 A.M. The training protocol consisted of carefully selected asanas designed to enhance upper body muscular strength; the control group continued with their routine activities without any structured physical training during the study period. Push-up tests were used in the study.

RESULTS AND DISCUSSION

Table 1 clearly shows the mean scores of the pre-test and post-test on upper body muscle strength of middle-aged women in the experimental and control groups. The average scores of the pre-test of the control group and the experimental group of female respondents are 5.64 and 11.72, respectively. This shows that the experimental group has a higher mean value of muscular endurance before the test than the control group. It was also observed that the mean values for the middle-aged female respondents in the experimental group and the post-test control group were 18.65 and 4.92, respectively. The post-test mean value of muscular endurance was found to be higher in the experimental group than the control group. It was found that the upper body muscle strength of the female respondents of the experimental group was better than the control group after 6 months of yogasana training.

CONCLUSION

Muscular strength also demonstrated statistically significant gains ($P < 0.05$), suggesting that regular practice of yogasanas contributes to improved neuromuscular coordination and strength development. Similarly, muscular endurance showed significant enhancement ($P < 0.05$), reflecting an increased ability of muscles to sustain prolonged activity without fatigue. In conclusion, the present study demonstrates that selected yogasana practices produce statistically significant improvements in physical variables among middle-aged women, as evidenced by P -values below the established level of significance.

Recommendations

The present study demonstrates that selected yogasana practices produce statistically significant improvements in physical variables among middle-aged women, as evidenced by P -values below the established level of significance. The findings underscore the effectiveness of yoga as a holistic, evidence-based approach to health promotion. Regular practice of yogasanas can lead to enhanced physical fitness, improved physiological functioning, and overall well-being. Therefore, the integration of yoga into daily routines and health promotion programs is strongly recommended to foster a healthier and more balanced lifestyle among middle-aged populations.

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Research Article

Development of a general physical conditioning training program for the sanest Khanh Hoa volleyball team, Vietnam

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ABSTRACT

Based on theoretical research and interview results, the author selected seven tests to assess physical fitness and 35 exercises to develop general physical conditioning for male youth athletes of the Sanest Khanh Hoa volleyball team, Vietnam. On the basis of the selected exercises, a general physical conditioning training program was developed for the male youth volleyball team of Sanest Khanh Hoa, Vietnam, during the general preparatory phase (initial stage). The results indicated that after two training cycles, the overall general physical fitness performance of the team showed a clear and significant improvement, with W% increases ranging from 6.69% to 25.24%. This improvement was statistically significant, meeting the reliability threshold at $P < 0.05$.

Keywords: General physical conditioning training, Physical fitness assessment, Training program, Vietnam, Youth volleyball

INTRODUCTION

At present, high-performance sport is one of the fields receiving special attention, no less than socio-cultural domains, reflecting humanity's aspiration to reach the highest levels of achievement. Consequently, human potential has been and continues to be fully exploited to attain high sporting performance in competitions (Toan, 1998). Technical-tactical skills, physical fitness, psychological functioning, willpower, and knowledge of athletes are decisive factors determining sporting success (Toan and Ton, 1993). Among these factors, physical performance capacity, particularly general physical fitness and sport-specific fitness, is considered the most important. This has been widely studied by leading scientists and experts both domestically and internationally and has consistently been a major focus of coaches throughout the training process. In athlete selection, the ability to tolerate training load is regarded as one of the fundamental evaluation criteria (Novikov and Matveev, 1980). The capacity to withstand high training loads depends on multiple factors, among which the level of physical fitness development plays a crucial role (Philin, 1996).

Physical training, especially general physical conditioning, is closely associated with the acquisition and refinement of athletes' skills and motor techniques. Comprehensive development of physical qualities enhances sport-specific capacities, enabling athletes to maintain training and competition intensity and performance across multiple sets, while reducing fatigue and the risk of exhaustion. Furthermore, improved physical fitness contributes to enhanced competitive performance by increasing strength, speed, movement rhythm, and recovery between key actions such as serving, blocking, jumping, and rapid court movement. It also plays a vital role in injury prevention and athlete safety, as well-developed musculature and periarticular strength help minimize injuries caused by overload, imbalance, or improper technique. In addition, a stable physical foundation provides a basis for technical and tactical advancement, allowing athletes to focus on skill and strategy development without being constrained by physical fatigue.

To ensure effectiveness in the training process, training planning plays a critically important role. Training plans for young athletes focus on achieving the highest possible sporting performance appropriate to their age group, while simultaneously preparing them for the future demands of high-performance sport. Therefore, research on the development of a general physical conditioning training program for male youth volleyball athletes of the Sanest Khanh Hoa team,

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Vietnam, is both necessary and meaningful, contributing to the improvement of athletic performance and competitive results.

RESEARCH METHODS

Document Review and Analytical Synthesis Method

This method was employed to synthesize relevant literature to formulate scientific assumptions, define research objectives, establish the theoretical framework, and guide the development of a system of tests for assessing training level, as well as the selection and proposal of training exercises for volleyball athletes.

Questionnaire-Based Interview Method

Through the use of questionnaires, issues related to the research topic were investigated, and opinions from experts and coaches were collected to identify appropriate tests for evaluating physical training level and to select exercises for male youth athletes of the Sanest Khanh Hoa volleyball team, Vietnam. The interview sample consisted of 30 participants, including team coaches and experts with extensive knowledge of the research subject.

Pedagogical Testing Method

The following assessment tests were employed: Standing long jump (cm): Assess lower-limb muscular strength; 30 m XPC run (s): Evaluate the ability to perform maximal-intensity activity within the shortest possible time, reflecting speed and acceleration capacity; Cooper test (m): Assess cardiorespiratory endurance and aerobic work capacity. During the 12-min test, the greater the distance covered, the higher the athlete's level of physical fitness; Ball throw test (m): Evaluate upper-limb strength; Flexibility (Sit-and-reach) test (cm): Assess flexibility, reflecting the range of motion of muscles and joints; Prone push-ups in 30 s (repetitions): Assess upper-body and shoulder strength, representing the ability to generate maximal muscular effort within a short period of time, measured by the number of repetitions performed; T-test (s): evaluate agility and movement coordination.

Mathematical-Statistical Methods

These methods were applied to process the data collected during the research, including the calculation of mean values, standard deviation, and percentages, among other indices (Lam and Minh Thuan, 2009).

Research Subjects

The research focused on the general physical conditioning training program for the male youth volleyball team of Sanest Khanh Hoa, Vietnam.

Theoretical Basis

Physical training in sports coaching is a fundamental component for improving athletic performance. However,

in essence, the level of development of physical qualities depends on the functional states and structural characteristics of organs and muscular systems within the human body (Buu and Truyen, 1991). The training process aimed at developing physical qualities is, in fact, the process of enhancing and optimizing the functional systems that play a primary role in specific muscular activities.

According to (Harre, 1996); (Phomin, 1987), and (Philin, 1996), regardless of the stage of the athlete's development process, general physical conditioning training is considered a key component, as general physical fitness together with sport-specific fitness forms the foundation for achieving high sporting performance.

However, it should be noted in several research studies (Nabatnhikova, 1985) that the training of general physical qualities must be a continuous, long-term process throughout the entire athlete development pathway. Depending on the objectives of each training phase, the proportion between general physical conditioning and sport-specific conditioning should be appropriately determined (Daxiorsky, 1978; Harre, 1996).

Another equally important issue, as emphasized by Phomin (1987), is that the physical training process must be aligned with appropriate training means (physical exercises) and training methods that correspond to the laws of development of the target population, including age and training level.

Physical training (also referred to as the process of developing general and sport-specific physical qualities) is a continuous and systematic process, conducted regularly and according to a well-structured plan using physical training exercises, to enhance movement quality and motor abilities. This process exerts profound effects on the nervous system, muscular system, and internal organs of the human body (Harre, 1996). Naturally, to achieve high performance in volleyball, athletes must first possess physical qualities that meet the sport-specific demands. However, this does not imply neglecting other aspects such as technical and tactical skills. Physical qualities are commonly classified into five fundamental components: speed, strength, endurance, coordination, and ability (agility/flexibility) (Daxiorsky, 1978).

The question arises: Why is general physical conditioning training necessary?

From the perspective of a practitioner involved in the training process, the author addresses this question as follows. General physical conditioning training enables athletes to enhance their ability to tolerate competitive demands, thereby improving overall performance. It contributes to improvements in strength, speed, movement rhythm, and recovery capacity between key volleyball actions such as serving, blocking, jumping, and rapid

court movement. Moreover, general physical conditioning plays a crucial role in ensuring athlete safety and injury prevention. A well-developed physical foundation helps minimize injuries caused by overload, imbalance, or improper technique. It also optimizes recovery time, as good general fitness supports faster recovery between training sessions and matches, allowing athletes to maintain consistent performance levels. In addition, enhanced general physical conditioning promotes flexibility and comprehensive preparedness, enabling athletes to execute a wider range of tactical variations during training and competition, such as positional rotation and flexible transitions between offensive and defensive play. A stable physical foundation further provides the basis for technical and tactical advancement, allowing athletes to focus on skill and strategy development without being constrained by physical fatigue. Finally, investing in the development of general physical conditioning helps optimize training efficiency by integrating technical-tactical practice with activities that enhance overall health and endurance. General physical fitness tests also provide an objective basis for monitoring progress, adjusting training programs, and individualizing training according to the specific needs of each athlete.

RESULTS AND DISCUSSION

Selection of physical fitness assessment tests for male youth volleyball athletes of the Sanest Khanh Hoa Team, Vietnam

To select appropriate general physical fitness assessment tests for male youth volleyball athletes of the Sanest Khanh Hoa team, Vietnam, the author collected, compiled, and systematized various tests from previous research studies and from practical coaching experience. Subsequently, questionnaire-based interviews were conducted with volleyball coaches and experts in the field of volleyball training to identify the most suitable assessment tests.

The interviews were conducted twice (with a 1-month interval between the first and second rounds) with the same group of respondents. It was stipulated that tests achieving an average agreement rate of 80% or higher across the two interview rounds would be selected for inclusion in the study. The results are presented in Table 1.

Test reliability assessment

To evaluate the stability and reliability of the selected tests, the study employed the chosen physical fitness assessment tests applied to the athletes. The assessment was conducted twice, with a 15-day interval between the first and second testing sessions. The results are presented as follows:

Thus, based on the results of expert interviews and the reliability testing of the selected tests, the study identified seven tests that met the established criteria, with a total

consensus rate of 80% or higher, including the 30 m sprint from a standing start (s), standing long jump (cm), two-hand basketball throw (m), 12-min run (Cooper test) (m), prone push-ups (repetitions), sit-and-reach flexibility test (cm), and the T-test (s). The correlation coefficients between the two testing occasions ranged from 0.81 to 0.93, indicating a strong level of correlation, with $P > 0.05$. These results confirm the reliability of the selected tests for application in evaluating the general physical fitness of the Khanh Hoa male youth volleyball team, Vietnam.

Current status of general physical fitness of male youth volleyball athletes of the Sanest Khanh Hoa Team, Vietnam

The results in Table 4 indicate that: In the push-up test (repetitions/minute), the team's mean performance was 34.50 ± 2.97 , with a coefficient of variation $C_v\% = 8.61\% < 10\%$, indicating a relatively homogeneous performance among the athletes. In the two-hand basketball throw test (m), the mean performance was 14.06 ± 0.52 , with $C_v\% = 3.69\% < 10\%$, showing a relatively uniform level among the athletes. For the standing long jump test (cm), the team achieved a mean value of 251.08 ± 5.52 , with $C_v\% = 2.19\% < 10\%$, reflecting high consistency in performance. In the 30 m sprint test (s), the average result was 4.81 ± 0.20 (s), with $C_v\% = 4.25\% < 10\%$, indicating relatively even performance among the athletes. For the sit-and-reach flexibility test (cm), the mean performance was 19.13 ± 1.45 (cm), with $C_v\% = 7.57\% < 10\%$, demonstrating a relatively homogeneous level of flexibility. In the 12-min run (Cooper test) (m), the team's mean distance was 1943.08 ± 75.67 (m), with $C_v\% = 3.89\% < 10\%$, indicating consistent aerobic endurance among the athletes. Finally, in the T-test (s), the mean performance was 10.84 ± 0.32 (s), with $C_v\% = 2.91\% < 10\%$, confirming a high degree of uniformity in agility performance across the team.

Development of a general physical conditioning training program for male youth volleyball athletes of the Sanest Khanh Hoa team, Vietnam

Selection of general physical conditioning exercises for male youth volleyball athletes of the Sanest Khanh Hoa team, Vietnam

Based on a review of relevant domestic and international literature related to the research topic, a total of 57 exercises were compiled and proposed. Following interviews with 30 experts and volleyball coaches, the study selected 35 exercises deemed appropriate for male youth volleyball athletes of the Sanest Khanh Hoa team, Vietnam, including:

- Flexibility development exercises (10 exercises): Trunk flexion, knee stretching, overhead shoulder stretching, back stretching, wrist stretching, front split stretching, side split stretching, backward shoulder stretching left and right, trunk rotation, and bilateral leg stretching.

Table 1: Results of the interview on the selection of general physical fitness assessment tests for male youth volleyball athletes of the Sanest Khanh Hoa Team, Vietnam

No.	Assessment criteria	Round 1 (n=30)		Round 2 (n=30)		Average (%) from two tests
		Total score	Percentage	Total score	Percentage	
	General physical fitness					
1	Two-hand basketball throw (m)	82	82	83	83	82.5
2	30 m sprint from a standing start (s)	87	87	90	90	88.5
3	20-m sprint (s)	78	78	78	78	78
4	6×9 m run (s)	77	77	78	78	77.5
5	Rolling and falling test (repetitions)	75	75	76	76	75.5
6	1500 m run (min)	79	79	77	77	78
7	Standing vertical jump (cm)	75	75	76	76	75.5
8	Standing long jump (cm)	86	86	86	86	86
9	Shuttle run (s)	69	69	71	71	70
10	Sit-and-reach flexibility test (cm)	85	85	86	86	85.5
11	Left hand grip strength (kg)	79	79	78	78	78.5
12	Change-of-direction movement (s)	78	78	77	77	77.5
13	T-test (s)	83	83	81	81	82
14	Back strength (kg)	77	77	75	75	76
15	Three-step standing jump (cm)	78	78	79	79	78.5
16	Harvard test (Hw)	78	78	77	77	77.5
17	Crunch in 30 s (repetitions)	78	77	77	76	77
18	Push-ups in 1 min (repetitions)	82	82	84	84	83
19	12-min run (Cooper test) (m)	84	84	85	85	84.5
20	Continuous vertical jumps (20 repetitions)	74	74	75	75	74.5
21	Composite performance test	79	79	78	78	78.5
22	Lateral movement test: 10 repetitions (4×3 m) (s)	74	74	76	76	75
23	Composite endurance test	77	77	77	77	77
24	Right hand grip strength (kg)	75	75	77	77	76
25	505 agility test (s)	75	75	77	77	76

Table 2: Paired correlation coefficients between the two testing sessions

No.	Test name	$\bar{x}_1$	$\bar{x}_2$	r	P-value
1	30 m sprint from a standing start (s)	4.80	4.82	0.93	> 0.05
2	Standing long jump (cm)	251.1	251.13	0.81	> 0.05
3	Two-hand basketball throw (m)	14.05	14.07	0.82	> 0.05
4	12-min run (Cooper test) (m)	1943.1	1943.12	0.86	> 0.05
5	Push-ups in 1 min (repetitions)	34.6	34.8	0.83	> 0.05
6	Sit-and-reach flexibility test (cm)	19.10	19.15	0.91	> 0.05
7	T-test (s)	10.82	10.79	0.88	> 0.05

- Speed, agility, and coordination exercises (6 exercises): Sprint running, 9–3–6–3–9 shuttle run, lateral movement running, defensive diving drills, rope skipping, and movement drills combined with ball passing.
- Strength training exercises (14 exercises): Wrist strengthening with barbell, supine barbell press, triceps extension behind the head, barbell squat, supine leg press, seated leg extension with weights, two-leg box jumps (60 cm), single-leg box jumps (40 cm), hurdle jumps combined with spiking, barbell squat jumps in place, hurdle jumps, resistance band pulls behind the head using the dominant arm, abdominal muscle exercises, and back muscle exercises.
- Endurance training exercises (5 exercises): 2,500 m continuous running, continuous spiking drills, continuous defensive drills, continuous blocking drills, and defensive-to-offensive transition drills (30 min).

Development of a general physical conditioning training program for the Sanest Khanh Hoa male youth volleyball team, Vietnam

The training program was implemented over two macrocycles (48 weeks). Each macrocycle consisted of 24 weeks and was divided into two phases: The general preparation phase and the specialized preparation phase. In this study, the program was designed and evaluated only during the general physical conditioning phase.

Macrocycle 1: The general preparation phase was conducted from Week 1 to Week 8 and included the following contents: Development of the training progression.

Table 3: Results of the assessment of the current general physical fitness of male youth volleyball athletes of the Sanest Khanh Hoa team, Vietnam

No.	Test	$\bar{x}$	δ	$C_v\%$
1	30 m sprint from a standing start (s)	4.81	0.20	4.25
2	Standing long jump (cm)	251.08	5.52	2.19
3	Two-hand basketball throw (m)	14.06	0.52	3.69
4	12-min run (Cooper test) (m)	1943.08	75.67	3.89
5	Push-ups in 1 min (repetitions)	34.50	2.97	8.61
6	Sit-and-reach flexibility test (cm)	19.13	1.45	7.57
7	T-test (s)	10.84	0.32	2.91

Table 4: Training progression of general physical conditioning during the general preparation phase

No.	Day content	2	3	4	5	6	7
1	Flexibility	x	x	x	x	x	x
2	Speed, agility, and coordination	x	x	x	x	x	x
3	Strength	x		x		x	
4	Endurance		x		x		x

Flexibility training during the general preparation phase: Flexibility exercises were incorporated at the beginning of each training session, following the general warm-up. The total duration of flexibility training was 10 min per session, with 8–10 exercises performed. Each exercise was executed for 8 s, with a 3-s hold, and a 30-s rest interval between exercises.

Speed, agility, and coordination training during the general preparation phase: Speed, agility, and coordination exercises were performed at the beginning of each training session, immediately after the general warm-up. The total training duration was 5 min per session, with 3–5 exercises conducted using the repetition method.

Strength training during the general preparation phase: Strength training was organized according to Bompa's periodization model (2000), focusing on the anatomical adaptation phase and the hypertrophy phase. The program included three upper-body exercises, three lower-body exercises, and two trunk exercises. Training intensity was set at 40–60% of 1RM during the anatomical adaptation phase and 60–80% of 1RM during the hypertrophy phase. Each exercise was performed for 3–5 sets, with 10–15 repetitions per set.

Endurance training during the general preparation phase: Endurance training was conducted for 15–20 min per session. General endurance exercises were scheduled on Saturdays.

Evaluation of the development of general physical fitness of male youth volleyball athletes of Khanh Hoa, Vietnam after one training cycle

The results presented in Table 9 indicate that after one training cycle, the general physical fitness levels of male youth volleyball athletes from Khanh Hoa, Vietnam showed a significant improvement. The highest rate of improvement was observed in the push-up test, with $W\% = 17.42\%$, while the lowest improvement was found in the T-test, with $W\% = 4.28\%$.

Table 5: Content of flexibility training during the general preparation phase

Training content	Sets	Repetitions	Intensity	Rest interval
Trunk flexion, knee stretching, upper shoulder stretching, back stretching, wrist stretching, longitudinal stretch, lateral stretch, backward shoulder stretch (left–right), trunk rotation, bilateral leg stretching	1	1	low	30 s

Table 6: Content of speed, agility, and coordination training during the general preparation phase

No.	Training content	Sets	Repetitions	Intensity	Rest interval (minute)
1	20-m sprint	4	1	High	1–2
2	9-3-6-3-9	2	2	High	1–2
3	Lateral movement drills	2	2	High	1–2
4	Defensive digging drills	3	10	High	1–2
5	Moving set drills	3	10	High	1–2

Table 7: Content of strength training during the general preparation phase

STT	Training content	Phase						Rest interval (minute)
		Anatomical adaptation			Hypertrophy			
		Weeks 1–4			Weeks 5–8			
1	Wrist strengthening with barbell	40/3	45/2	50/1	60/3	70/2	75/1	1-2
		20	15	10	15	10	8	
2	Supine barbell press/Bench press	40/3	50/2	60/1	60/3	70/2	80/1	1-2
		20	15	10	15	10	8	
3	Overhead triceps extension	40/3	55/2	60/1	60/3	70/2	80/1	1-2
		20	15	10	15	10	8	
4	Barbell back squat	60/3	70/2	80/1	80/3	90/2	100/1	1-2
		20	15	10	15	10	8	
5	Supine leg press	50/3	55/2	60/1	60/3	70/2	80/1	1-2
		20	15	10	15	10	8	
6	Seated leg curl and leg extension with weights	50/3	55/2	60/1	60/3	70/2	80/1	1-2
		20	15	10	15	10	8	
7	Abdominal exercises	20 repetitions/3 sets			20 repetitions/5 sets			1-2
8	Back exercises	20 repetitions/3 sets			20 repetitions/5 sets			1-2

Table 8: Content of endurance training during the general preparation phase

No.	Training content	Sets	Repetitions	Intensity	Rest interval (minute)
General endurance					
1	2000 m run	1	1	Medium- low	5

Table 9: Assessment of the development of general physical fitness of male youth volleyball athletes of Khanh Hoa after one training cycle ($n=12$)

No.	Test	Indicator							
					Cv	W _%	t	P-value	
1	Push-ups in 1 min (repetitions)	1 st time	34.5	2.97	8.61	0.05	17.42	14.06	<0.05
		2 nd time	41.08	2.94	7.15	0.04			
2	30 m sprint from a standing start (s)	1 st time	4.81	0.20	4.25	0.04	6.51	8.13	<0.05
		2 nd time	4.51	0.18	4.03	0.02			
3	Standing long jump (cm)	1 st time	251.08	5.52	2.20	0.01	4.57	5.08	<0.05
		2 nd time	262.83	6.78	2.58	0.01			
4	Two-hand basketball throw (m)	1 st time	14.06	0.52	3.70	0.02	9.0	14.91	<0.05
		2 nd time	15.39	0.62	4.01	0.02			
5	12-min run (Cooper test) (m)	1 st time	1943.08	75.67	3.89	0.02	11.75	7.2	<0.05
		2 nd time	2185.67	89.63	4.10	0.04			
6	Sit-and-reach flexibility test (cm)	1 st time	19.13	1.45	7.57	0.04	8.15	5.39	<0.05
		2 nd time	20.17	1.85	8.93	0.05			
7	T-test (s)	1 st time	10.84	0.32	2.91	0.01	4.28	6.48	<0.05
		2 nd time	10.39	0.44	4.20	0.02			

These improvements were statistically significant, as $t_{\text{table}} < t_{\text{calculated}}$ at the $P < 0.05$ significance level.

Macrocycle 2: The general preparation phase was also conducted over 8 weeks.

Flexibility training during the general preparation phase: Flexibility exercises were incorporated at the beginning of

each training session, following the general warm-up. The total duration of flexibility training was 10 min per session, with 8–10 exercises performed. Each exercise was executed for 8 s, with a 3-s hold, and a 30-s rest interval between exercises.

Speed, agility, and coordination training during the general preparation phase: Speed, agility, and coordination exercises were performed at the beginning of each training session, immediately after the general warm-up. The total training duration was 5 min per session, with 3–5 exercises conducted using the repetition method.

Strength training during the general preparation phase: Strength training was organized according to Bompa's periodization model (2000), focusing on the anatomical adaptation phase and the hypertrophy phase. The program included three upper-body exercises, three lower-body exercises, and two trunk

Table 10: Physical conditioning training progression during the general preparation phase

No.	Day content	2	3	4	5	6	7
1	Flexibility	x	x	x	x	x	x
2	Speed, agility, and coordination	x	x	x	x	x	x
3	Strength	x		x		x	
4	Endurance		x		x		x

Table 11: Content of flexibility training during the general preparation phase

Training content	Sets	Repetitions	Intensity	Rest interval
Trunk flexion, knee stretching, upper shoulder stretching, back stretching, wrist stretching, longitudinal stretch, lateral stretch, backward shoulder stretch (left–right), trunk rotation, bilateral leg stretching	1	1	Low	30 s

Table 12: Content of speed, agility, and coordination training during the general preparation

No.	Training content	Sets	Repetitions	Intensity	Rest interval (minute)
1	20-m sprint	4	1	High	1–2
2	9-3-6-3-9	2	2	High	1–2
3	Lateral movement drills	2	2	High	1–2
4	Defensive digging drills	3	10	High	1–2
5	Moving set drills	3	10	High	1–2

Table 13: Content of strength training during the general preparation phase

No.	Training content	Phase						Rest interval
		Anatomical adaptation			Hypertrophy			
		Weeks 1–3			Weeks 4–5			
1	Wrist strengthening with a barbell	40/3	45/2	50/1	60/3	70/2	80/1	1–2 min
		20	15	10	15	10	8	
2	Supine barbell press (bench press)	40/3	50/2	60/1	60/3	70/2	80/1	1–2 min
		20	15	10	15	10	8	
3	Resistance band pull-down behind the head (dominant arm)		3 sets/20			5 sets/20		30 s
4	Barbell back squat	60/3	70/2	80/1	70/3	75/2	80/1	1–2 min
		20	15	10	15	10	8	
5	Two-leg box jumps		50 cm			60 cm		30 s
6	Single-leg box jumps		50 cm			60 cm		30 s
7	Abdominal exercises		20/3			20/5		30 s
8	Back muscle exercises		20/3			20/5		30 s

exercises. Training intensity was set at 40–60% of 1RM during the anatomical adaptation phase and 60–80% of 1RM during the hypertrophy phase. Each exercise was performed for 3–5 sets, with 10–15 repetitions per set.

Endurance training during the general preparation phase: Endurance training was conducted for 15–20 min. General endurance exercises were scheduled on Saturdays.

Evaluation of the development of physical fitness qualities of male youth volleyball players of the Sanest Khanh Hoa team, Vietnam, in Cycle 2.

The results presented in Table 15 indicate that after training in Cycle 2, the general physical fitness level of the male youth volleyball athletes of Khanh Hoa, Vietnam, continued to show a clear improvement at the end of Training Cycles 1 and 2. The highest rate of improvement was observed in the Cooper test, with $W\% = 13.94\%$, while the lowest rate was recorded in the flexibility test (sit-and-reach), with $W\% = 2.07\%$. These improvements were statistically significant, as $t_{\text{calculated}} > t_{\text{table}}$ at the significance level of $P < 0.05$.

Table 14: Content of endurance training during the general preparation phase

No.	Training content	Sets	Repetitions	Intensity	Rest interval (minute)
General endurance					
1	2000 m run	1	1	Medium-low	5

Evaluation of the physical fitness development of male youth volleyball athletes of the Sanest Khanh Hoa team, Vietnam after 1 year of training

The results presented in Table 16 show that after training in Macrocycle 2, the general physical fitness level of male youth volleyball athletes of Khanh Hoa, Vietnam exhibited a clear improvement between the baseline condition (initial data) and after 1 year of training. The highest rate of improvement was observed in the Cooper test, with $W\% = 25.24\%$, while the lowest rate of improvement was found in the t-test, with $W\% = 6.69\%$. These improvements were statistically significant, with $t_{\text{calculated}} > t_{\text{table}}$ at the significance level of $P < 0.05$.

DISCUSSION

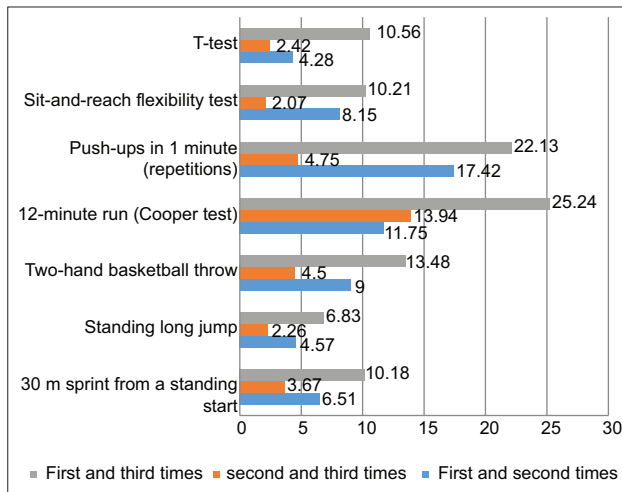
In recent years, volleyball specialists have continuously studied and applied a wide range of training methods and means to enhance athletes' competitive performance in line with the development trends of modern volleyball. According to the holistic development perspective of the sports talent training system, attention must be given to multiple aspects, including body morphology, physical fitness, technical-tactical skills, and psychological factors. Each of these aspects represents a constituent capacity, among which motor abilities are particularly emphasized and highly valued in terms of their level of importance. There have been numerous scientific studies on related issues, such as (Nguyen Bao Ninh. 2007), "Research on building criteria for evaluating the development of specialized physical fitness for male students specializing in volleyball in the physical education major at the University of Sports and Physical Education" (Bui Trong Toai. 1996),

Table 15: Assessment of the development of physical fitness qualities of male youth volleyball players of the Sanest Khanh Hoa team, Vietnam, in Cycle 2

No.	Content	Indicator						
					Cv	W _%	t	P-value
1	Push-ups in 1 min (repetitions)	2 nd time	41.08	2.94	7.15	4.75	9.38	<0.05
		3 rd time	43.08	2.91	6.75			
2	30 m sprint from a standing start (s)	2 nd time	4.51	0.18	4.03	3.67	4.45	<0.05
		3 rd time	4.35	0.22	5.07			
3	Standing long jump (cm)	2 nd time	262.83	6.78	2.58	2.26	22.79	<0.05
		3 rd time	268.8	6.97	2.59			
4	Two-hand basketball throw (m)	2 nd time	15.39	0.62	4.01	4.5	9.16	<0.05
		3 rd time	16.1	0.52	3.23			
5	12-min run (Cooper test) (m)	2 nd time	2185.67	89.63	4.10	13.94	12.88	<0.05
		3 rd time	2513.3	23.67	0.94			
6	Sit-and-reach flexibility test (cm)	2 nd time	20.17	1.85	8.93	2.07	13.00	<0.05
		3 rd time	21.18	1.83	8.65			
7	T-test (s)	2 nd time	10.39	0.32	2.91	2.42	8.97	<0.05
		3 rd time	10.14	0.39	3.86			

Table 16: Development of general physical fitness of male youth volleyball athletes of the Sanest Khanh Hoa team, Vietnam after 1 year of training

No.	Content			Indicator				
					Cv	W _%	t	P-value
1	Push-ups in 1 min (repetitions)	1 st time	34.5	2.97	8.61	22.13	17.18	<0.05
		3 rd time	43.08	2.91	6.75			
2	30 m sprint from a standing start (s)	1 st time	4.81	4.25	0.04	10.18	8.11	<0.05
		3 rd time	4.35	0.22	5.07			
3	Standing long jump (cm)	1 st time	251.08	5.52	2.20	6.83	7.64	<0.05
		3 rd time	268.8	6.97	2.59			
4	Two-hand basketball throw (m)	1 st time	14.06	0.52	3.70	13.48	19.16	<0.05
		3 rd time	16.1	0.52	3.23			
5	12-min run (Cooper test) (m)	1 st time	1943.08	75.67	3.89	25.24	23.5	<0.05
		3 rd time	2513.3	23.67	0.94			
6	Sit-and-reach flexibility test (cm)	1 st time	19.13	1.456	7.57	10.21	6.61	<0.05
		3 rd time	21.18	1.83	8.65			
7	T-test (s)	1 st time	10.84	0.32	2.91	6.69	10.56	<0.05
		3 rd time	10.14	0.39	3.86			

**Chart 1:** Comparison of the growth rates of general physical fitness indicators of male youth volleyball athletes from the Sanest Khanh Hoa team, Vietnam, after 1 year of training

“Preliminary construction of a physical fitness test system for female volleyball athletes” by; the doctoral thesis results of (Lam, 1998) titled “Research on characteristic physical qualities of female volleyball athletes aged 15–18.”

In the present study, based on the evaluation of the development of general physical fitness of male youth volleyball athletes from the Sanest Khanh Hoa team, Vietnam, after 1 year of training, the results indicate that all seven selected fitness tests showed improvements. This growth is consistent with age-related developmental patterns as well as the principles of adaptation in sports training. When comparing the growth

rates of general physical fitness indicators among individual athletes across different training phases, the findings reveal that most athletes demonstrated progressive improvements, with each athlete exhibiting prominent growth in specific fitness indicators. This reflects a trend toward the development of physical qualities in accordance with the positional specialization defined by the team’s training orientation.

Furthermore, an analysis of the overall average growth rate of the entire team shows variations among training phases; however, all phases followed a positive trend, with later results surpassing earlier ones. These findings confirm that the scientific selection of training exercises and the development of an appropriate training plan have effectively contributed to improving training outcomes.

CONCLUSION

Based on the research results addressing the objectives of the study, the following conclusions are drawn:

The research identified 7 assessment tests and 35 exercises for the development of general physical fitness for the Sanest Khanh Hoa male youth volleyball team, Vietnam. At the same time, a general physical fitness training program was developed following two training macrocycles (1-year duration), and the selected exercises were applied in practice, including 10 flexibility exercises, 5 speed exercises, 14 strength exercises, and 4 endurance exercises.

After 1 year of training, the general physical fitness level of the male youth volleyball athletes from Sanest Khanh

Hoa, Vietnam showed significant improvements. General fitness development was most pronounced in strength-related tests, including push-ups ($W\% = 22.13\%$), two-hand basketball throw ($W\% = 13.48\%$), and standing long jump ($W\% = 6.83\%$). Regarding endurance, the Cooper test showed an improvement of $W\% = 25.24\%$. Improvements were also observed in speed (30 m sprint: $W\% = 10.18\%$), flexibility (sit-and-reach: $W\% = 10.21\%$), and agility–coordination (T-test: $W\% = 10.56\%$). These results provide a solid foundation for subsequent training stages, particularly for the acquisition of technical and tactical skills and the further development of sport-specific physical fitness.

ACKNOWLEDGMENTS

To complete this research, I would like to express my sincere gratitude to the leaders and athletes of the Sanest Khanh Hoa men's youth volleyball team, Vietnam, for providing me with the opportunity and time to conduct this research. This research was partially funded by the University of Finance - Marketing, Vietnam.

This paper is the work of a group of authors. The data and results are accurate and do not duplicate other research.

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Research Article

Obstacles to the implementation of physical education programs in iraqi government secondary schools from the perspective of teachers

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ABSTRACT

Research Problem: Physical education (PE) programs in Iraqi state secondary schools face multi-dimensional obstacles that prevent them from achieving their educational objectives. Despite their vital importance to the holistic development of pupils, previous studies have not provided an in-depth quantitative analysis of these obstacles in the Iraqi context. **Methodology:** The study adopted a descriptive-analytical approach. The research population comprised 13,434 teachers, and a stratified random sample of 374 teachers (representing 4%) was selected. The “barriers” section of a questionnaire designed for teachers (adapted from the researcher’s doctoral thesis) was used, comprising 11 items distributed across four domains. Validity and reliability were verified, with a Cronbach’s alpha coefficient of (0.952), indicating a high degree of internal consistency. **Results and Discussion:** The results showed that the physical domain ranked first with a mean of (2.06), followed by the administrative domain (2.35), then the human domain (2.40), and finally the professional domain (2.53). The predominance of material constraints is attributed to decades of declining investment in sports infrastructure, as well as the low priority accorded to this subject compared to academic subjects, which has led to the marginalization of the teacher’s role. These gaps point to the almost complete absence of an effective evaluation system, which explains the persistent gap between the program’s theoretical planning and its practical implementation. **Conclusion:** The program’s limited impact is attributed to the accumulation of these constraints, a lack of flexibility in the curriculum, and weak feedback mechanisms. The researcher recommends designing a specialized curriculum, modernizing the infrastructure, allocating regular budgets, and developing teachers’ performance through continuous training programs, while establishing a national database of performance indicators to ensure sustainability and quality. This paper is derived from the researcher’s unpublished PhD dissertation, titled “Evaluation of the Physical Education Program in Government Secondary Schools in Iraq”.

Keywords: Evaluation, Implementation barriers, Physical education program, State secondary schools, Teachers

INTRODUCTION

In light of recent developments, obstacles, and challenges facing the education system, physical education (PE) is an integral part of the comprehensive education system, as it contributes to the development and character-building of students in all aspects intellectual, physical, psychological, and social. PE enables students to acquire skills for dealing with emergencies and helps them adopt a healthy lifestyle.

According to Tan *et al.* (2014), the importance of PE as a core subject in the curriculum of state secondary schools is evident, given its key role in preparing and shaping a generation capable of meeting the challenges and demands of modern life. Advanced education systems have paid close attention to improving and developing PE programs to provide a suitable environment for their implementation, thereby achieving the desired objectives (UNESCO, 2015). Understanding these obstacles is essential for making improvements and developing high-quality PE programs in secondary schools, both now and in the future.

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The Iraqi educational landscape has faced numerous significant challenges and obstacles over the past decades

due to the political, economic, and security circumstances experienced by Iraq. These circumstances have had a negative impact on the education system, including the PE program, which faces obstacles to its implementation in Iraqi state secondary schools, preventing the achievement of the intended objectives of the subject. The obstacles are varied, ranging from professional, administrative and technical to environmental, and therefore require an in-depth scientific study to identify the nature of the problems and recommend appropriate solutions (Al-Dulaimi, 2018).

Hill (2005) argues that school sport is fundamental to the development of participants' attitudes and inclinations toward sporting activity, beginning in childhood and continuing through to the competitive level, and that efforts should be made to modernize the curriculum and scientific methods and approaches to achieve inclusive sport and foster active citizenship.

An analysis of the educational literature indicates that the success of any educational program depends on a number of key factors, including: A qualified teacher, an appropriate program, available resources, effective supervision, administrative support, assessment, and feedback. Specifically in the field of PE, the importance of these factors is heightened due to the nature of the practical subject, which requires specific spaces, tools, and equipment.

When sport and physical activity are taken up at an early age, healthy lifestyles develop in children and adolescents, which helps to reduce health risks in adulthood (Dobins *et al.*, 2009); therefore, a good education from an early age is of paramount importance. Schools are therefore regarded as key health-promoting environments and are called on to give greater attention to PE and physical activity programs (Naylor and McKay, 2009; Byte *et al.*, 2006).

This highlights the importance of this study in attempting to identify and analyze the barriers to the implementation of PE programs in state secondary schools in Iraq from the perspective of teachers, as they are the party closest to and most involved with the program within the educational process.

Research Problem

PE programs in state secondary schools in Iraq face fundamental barriers that limit their effectiveness in achieving their educational and pedagogical objectives. These obstacles are multi-dimensional and have a negative impact on the quality of education provided to pupils and on the achievement of the desired objectives of teaching this vital subject, despite the importance of the PE program in helping pupils achieve holistic development, the researcher's knowledge of the educational reality, gained from his work as a teacher in a state secondary school, as well as his experience and field observations, indicates clear shortcomings in the implementation of these

programs in state secondary schools. These shortcomings relate to material and human resources, as well as a lack of government and organizational support.

Physical and sporting education has become a focus of attention for all peoples, as there is scarcely a society that does not practice some form of it. With its systems and rules, it constitutes an important and broad field within general education and is a fundamental element in preparing the individual to contribute to the building of society, as it reflects behaviors that are structured by its educational nature and within its interactive framework within groups. It also contributes to the intellectual, emotional, and physical development of the individual throughout the stages of their life, and enables them, socially, to develop moral qualities such as discipline, obedience, and respect.

The effective, smooth, and safe delivery of PE is greatly influenced by the school environment as well as adequate physical facilities. However, the lack of physical facilities and sports equipment continues to pose a challenge to the delivery of PE in schools to this day. A study conducted by Ismail and Mohammed (2016) found that a shortage of sports facilities and playgrounds was the main obstacle to the implementation of PE in the schools of Orange Asli. In addition, a shortage of equipment also occurs because it is not returned after being borrowed by pupils.

A study by Al-Leheeby and Al-Oun (2015) highlighted multiple obstacles facing the implementation of the PE curriculum in Iraqi schools, finding that professional obstacles ranked first, followed by constraints relating to material, human, and supervisory resources. Similarly, a study by Hardman *et al.* (2013) in their global survey of school PE showed that developing countries, including Iraq, face significant challenges in providing the necessary facilities and equipment and in training teachers appropriately.

Amidst all this, the PE and sports teacher is regarded as a cornerstone and a crucial element in achieving the objectives set for this subject; to this end, a set of key conditions must be in place for them to carry out these tasks. However, the latter has not yet achieved what was hoped for.

Hence, the research question takes the following form:

What are the obstacles facing the implementation of PE programs in state secondary schools in Iraq from the teachers' perspective?

Significance of the Research

The significance of this research lies in a number of scientific and practical considerations, the most important of which are as follows:

- The urgent need to examine the current state of the PE program in Iraqi state secondary schools to identify, in a scientific and systematic manner, the problems hindering the program's implementation
- The practical significance of the research is highlighted by the questionnaire developed in the researcher's thesis, from which this study is derived
- The scarcity of Iraqi studies that have examined the PE program in a comprehensive and in-depth manner means that this research makes a very significant contribution to Iraqi educational literature
- The practical significance of the study's findings lies in assisting decision-makers in the educational sector to develop the program by devising effective strategies
- To the best of the researcher's knowledge, this study is the first of its kind in Iraq to address the obstacles to the implementation of the PE program in state secondary schools.

Research Objectives

This research aims to achieve the following objectives:

1. To identify the main obstacles facing the implementation of the PE program in state secondary schools in Iraq from the teachers' perspective
2. To rank these obstacles (professional, material, human, and administrative) according to their degree of impact on the implementation of the program
3. What are the proposed solutions and recommendations to overcome these obstacles from the perspective of the study sample, specifically the teachers?

Scope of the Study

Thematic limitations

The study is limited to identifying the obstacles facing the implementation of PE programs in Iraqi state secondary schools.

Human limitations

The study is limited to a sample of 374 teachers in Iraqi state secondary schools.

Spatial limitations

State secondary schools in Iraqi governorates that were accessible during the study period.

Temporal limitations

The study was conducted during the academic year (2025–2026).

THEORETICAL FRAMEWORK

The Concept of Barriers to the Implementation of PE Programs

PE programs in educational institutions face multidimensional challenges that hinder their effective implementation, as

institutional, organizational, and human factors intertwine within a complex framework that limits the quality of implementation (Ebako and Lator, 2024). These barriers are classified into three main categories: Structural and resource-related barriers, barriers relating to teachers' professional competence, and political and organizational barriers.

Physical and infrastructural constraints are among the most significant barriers to the implementation of PE programs. These barriers include: A lack of suitable sports facilities; overcrowded classrooms; limited access to adapted equipment and teaching resources; inadequate specialist training for teachers; and a lack of funding, enforcement mechanisms and monitoring (Ebako and Lator, 2024; UNESCO and Loughborough University, 2024). In resource-constrained contexts, indoor spaces are often multi-purpose, which limits their use for physical activities (McMorris *et al.*, 2025). Furthermore, the lack of funding allocated to PE programs, and their lower priority compared to other academic subjects, lead to the marginalization of these programs within the education system (Ebako and Lator, 2024; Santos *et al.*, 2024).

LITERATURE REVIEW

Arabic Studies

Al-Oun and Al-Leheeby (2015) conducted an important study on the barriers to the implementation of the PE curriculum in Iraqi state schools from the perspective of teachers in Anbar Governorate. The study involved a sample of teachers and supervisors and concluded that the barriers fell into five main categories with varying arithmetic means, indicating the existence of genuine problems affecting the implementation of PE programs.

The study by Al-Obaidi and Al-Jabouri (2019) "Barriers to the implementation of the PE curriculum in secondary schools in Baghdad Governorate"

The study involved a sample of 180 male and female teachers and found that a lack of tools and equipment was the greatest obstacle (arithmetic mean 4.35 out of 5), while weak administrative support ranked second; differences were found between schools based on location (city center versus outskirts).

Foreign Studies

Jenkinson and Benson (2010) "Barriers to providing PE in Victorian secondary schools."

An Australian study of 319 secondary schools. It revealed: A lack of sports facilities (67% of schools), insufficient allocated teaching time (58%), weak support from school management (45%), and a heavy teaching workload for teachers.

Ojo (2015) conducted a study aimed at identifying the barriers to teaching PE in secondary schools in Nigeria. The study was conducted on a sample of 90 PE teachers in secondary schools in Ado Metropolis, Ekiti State. A descriptive survey approach was adopted as it was appropriate for the study's procedures, and a questionnaire was used as the data collection tool. The results of the study showed that the barriers to teaching PE, ranked according to their magnitude of impact, were related to teacher competence, gender, available facilities and resources, and the level of student interest in PE, while the size of the curriculum was found to be the least significant barrier to teaching PE. The study recommended the importance of employing highly competent teachers and sports coaches in all primary and secondary schools in Nigeria.

Commentary on Previous Studies

METHODOLOGY

Research Approach

The study adopted the descriptive analytical method as the most appropriate for the nature and objectives of the study. This method involves describing the phenomenon (obstacles) as it

actually is, analyzing the collected data and drawing conclusions, interpreting the relationships between the various variables, and presenting evidence-based solutions and recommendations.

Study Population

The study population consists of teachers in state secondary schools implementing PE programs. The study population totaled approximately 13,434 teachers in state secondary schools across Iraq for the 2024–2025 academic year.

Study Sample

Sampling method

Given the size and geographical distribution of the study population, a representative sample was selected using:

Stratified random sampling of teachers

- A random sample was drawn from each stratum in proportion to its size.

Sample Size and Characteristics

For the research sample, the researcher selected a sample using the stratified random sampling method from a total of 374 PE teachers, in accordance with the relevant statistical ratio (Stephen Thompson's formula); Table 2 illustrates this.

Study Tool

This study focused on the theme "Barriers to the implementation of the physical education program," comprising 11 items extracted from a questionnaire developed by the researcher for his doctoral thesis. The final version of the research instrument consisted of 78 items, distributed across seven sub-themes. Responses were measured using a five-point Likert scale (strongly agree, agree, neutral, disagree, and strongly disagree).

Research procedures

The researcher included this section in the questionnaire for his thesis, having first verified its validity, with the aim of examining the obstacles affecting the implementation of the PE program in state secondary schools in Iraq, as perceived by teachers.

Steps in preparing the research instrument (questionnaire)

To achieve the research objectives, the researcher followed the steps and procedures outlined below:

1. Literature review and identification of themes: The researcher analyzed the content of a range of previous studies and institutional reports, including scientific research, official assessment tools and reports from accredited government bodies, to gather the data required for the study and to identify the themes for the questionnaire (for teachers), the researcher adopted a selection frequency of 50% or more for the topics to be included in the questionnaire
2. Drafting the questionnaire items: After identifying the topics, the researcher drafted the questionnaire items

Table 1:

Points of agreement	Points of difference
All studies confirmed the existence of multiple barriers to the implementation of physical education programs	The ranking of these obstacles varied according to the local context
Financial constraints and resources were the most frequently cited	Foreign studies have focused more on psychological and educational aspects
The gap between what is planned and what is implemented is evident in most contexts	Arab studies have highlighted the role of societal and cultural factors
There is a need to develop curricula and provide continuous training	Iraqi studies added the dimension of security challenges and wars
What the current study adds	
Comprehensiveness: Incorporates multiple perspectives (teachers)	
Comprehensiveness: Forms part of a broader evaluative study of the physical education program in state secondary schools in Iraq	
Timeliness: Reflects the current reality of physical education in Iraq	
Depth: Covers all aspects of the obstacles in detail	
Practicality: It provides practical recommendations that can be implemented by the relevant authorities	

Table 2:

Type of research sample	Samples				Grand Total	Percentage of total population	Proportion of the sample relative to the population (%)
	Research sample	Percentage	Survey	Percentage			
Physical education teachers	334	89.3	40	11.9	374	100	7.2

and formulated them in their initial version, drawing on previous studies and published scientific research in the field of PE program evaluation

3. Verifying the validity of the items (face validity): The questionnaire in its initial form was presented to a group of experts and specialists in the field of PE and teaching methods, and they were asked to give their opinions on the clarity of the statements and their relevance to the respective theme. A consensus rate of 75% or more among the experts' opinions was adopted as the criterion for retaining, amending, or deleting a statement
4. Pilot study: After making the necessary amendments based on the experts' opinions, the researcher administered the questionnaire to a pilot sample of 40 teachers, with the aim of verifying the psychometric properties (validity and reliability) of the instrument
5. Verification of construct validity (discriminant validity): To ensure that the items were capable of distinguishing between respondents, the researcher calculated discriminant validity in two ways (as explained later in section 3.7.1), using the two-extreme-groups method (top 27% and bottom 27%) and the correlation between the item and the total score
6. Verification of the instrument's stability (internal consistency): To ensure the reliability of the questionnaire, the researcher calculated the stability coefficients using: Cronbach's alpha, the Spearman-Brown correlation coefficient for split-half testing, and Guttman's equation for unequal split-half testing.

Validity and reliability of the instrument

Construct validity

The researcher verified the construct validity of the scale by calculating the discriminant validity of the items using the two-extreme-groups method, the correlation between each item and the total score, and the relationship between each item and the factor to which it belongs, as shown in Tables 3-5.

- The two-extreme-groups method: The total scores obtained by the questionnaire respondents were ranked in descending order, and then divided into two groups: The top 27% as the high group and the bottom 27% as the low group.

To verify the discriminatory power of the items, the researcher administered the questionnaire to a sample of 40 male and female teachers in Iraq; after marking their responses and

ranking the questionnaires in descending order, in light of this ranking, the researcher selected the top 27% of scores as the high group and the bottom 27% as the low group. The calculated value served as an indicator of the discriminatory power of each item when compared with the table value; Table 3 illustrates this.

The significance of the differences between the means of the top and bottom groups on the PE program questionnaire items using the two-group test.

Table 3 shows that all items are significant when compared with the critical value of (1.96) at a significance level of (0.05).

- Method of the relationship between the item and the axis and the relationship between the item and the total score (internal consistency) Internal Consistency Method

After obtaining the responses from the pilot study sample to the questionnaires, the internal consistency reliability coefficients of the questionnaire were verified; the Pearson correlation coefficient was calculated for each item of the questionnaire in relation to the total score. The internal consistency reliability coefficients of the questionnaire were also verified by calculating the correlation coefficient between the score of each item and its respective axis, using the statistical software Statistical Package for the Social Sciences, as shown in Tables 4 and 5.

Table 4 shows the correlation values between the items and the total score for the axis, and that all items were significant at the 0.05 level of significance. This indicates that the items for each axis are valid in measuring what the axis is intended to measure.

Table 5 shows the correlation coefficients of the items with the total questionnaire score. It is evident that all items are statistically significant at the 0.05 level, and that two items with non-significant correlation coefficients were excluded from the questionnaire, namely, items (F2, F9), as shown in Table 12. Consequently, the total number of questionnaire items is now 11.

After calculating the discrimination coefficient for the teachers' scale (obstacles axis), and in light of the aforementioned procedures and statistical analysis of the data obtained from the discrimination sample – using the methods of (external

Table 3:

No.	Items	Group	N	Mean	Standard	T
F1	The school management's lack of interest in the PE program does not hinder its implementation	Upper	40	4.27	786.0	6.113
		Lower		2.36	674.0	
F2	A lack of administrative support does not hinder the program's implementation	Upper		4.18	603.0	8.367
		Lower		1.64	809.0	
F3	Large class sizes do not hinder the implementation of the PE program	Upper		3.82	603.0	5.579
		Lower		2.09	831.0	
F4	The lessons allocated to the PE program achieve its objectives and meet the students' needs	Upper		4.18	751.0	4.644
		Lower		2.64	809.0	
F5	A lack of financial resources and sports equipment does not hinder the implementation of the PE program	Upper		4.27	786.0	5.612
		Lower		2.36	809.0	
F6	The limited number of training courses available to PE teachers adequately meets their professional needs	Upper		4.27	647.0	5.185
		Lower		2.27	1.104	
F7	The negative attitude of some teachers and pupils toward PE is not considered an obstacle to the implementation of the program	Upper		3.91	539.0	5.573
		Lower		2.00	1.000	
F8	The lack of cooperation from parents in supporting the PE program does not hinder its implementation	Upper		4.18	751.0	7.089
		Lower		1.64	924.0	
F9	A lack of human resources does not hinder the implementation of the PE program	Upper		4.18	874.0	5.391
		Lower		2.09	944.0	
F10	The lack of incentives for outstanding teachers and students excelling in sport does not hinder the implementation of the program	Upper		4.18	603.0	8.216
		Lower		1.73	786.0	
F11	The fact that some PE teachers do not have academic qualifications does not hinder the implementation of the program	Upper		4.00	632.0	10.808
		Lower		1.36	505.0	
F12	The lack of ongoing training programs to develop teachers' skills does not affect the quality of the program's implementation	Upper		4.27	647.0	8.293
		Lower		1.73	786.0	

PE: Physical education

Table 4: Correlation coefficients between the score for each item and its respective axis in the Physical Education Program questionnaire

F13	F12	F11	F10	F9	F8	F7	F6	F5	F4	F3	F2	F1	Ferry number
796.0**	827.0**	914.**	846.0**	777.0**	865.0**	735.0**	766.0**	652.0**	742.0**	789.0**	841.0**	796.0**	PC

**Correlation is significant at the 0.01 level (two-tailed), *Correlation is significant at the 0.05 level (two-tailed), PC: Pearson correlation

Table 5: Correlation coefficients between the score for each item and the total score for the Physical Education Program questionnaire

F13	F12	F11	F10	F9	F8	F7	F6	F5	F4	F3	F2	F1	Ferry number
733.0**	813.0**	884.0**	810.0**	0.257	832**	728.0**	766.0**	728.0**	663.0**	779.0**	0.343	748.0**	PC

**Correlation is significant at the 0.01 level (two-tailed), *Correlation is significant at the 0.05 level (two-tailed), PC: Pearson correlation

consistency) for the two extreme groups and (internal consistency) – the relationship between the item and the total score – the final number of items was 11. The aforementioned procedures demonstrate the validity and reliability of the test, which are indicators of the test's necessary psychometric properties.

Reliability

- Half-split method – split: The scores from the pilot sample were used to calculate the reliability of the questionnaires using the split-half method for the items (single and paired), by calculating the correlation coefficient between the single and paired items. The length was then adjusted

Table 6: This paper examines the reliability of the questionnaire (for teachers) and its sub-scales using a split-half method for the items (single-item and paired-item) (Spearman-Brown-Guttman)

Factor	Number of items	Correlation coefficient between the two halves of the questionnaire	Reliability coefficient adjusted for scale length
Obstacles	13	0922.0	0960.0

Table 7: The reliability coefficients for the teachers' questionnaire calculated using Cronbach's alpha

Axis	Items	Arithmetic mean	Coefficient of variation	Standard deviation	Cronbach's alpha value
Obstacles	13	4290.0	138605.0	11773.0	0952.0

using the Spearman-Brown coefficient, as shown in Table 6.

- Alpha-Crow-Nabach: The Cronbach's alpha coefficient for the questionnaire as a whole was 0.952, which is a very high and reliable coefficient of stability, confirming that the instrument possesses a high degree of internal consistency and stability.

Criteria for scoring and interpreting responses:

A five-point Likert scale (strongly agree, agree, neutral, disagree, and strongly disagree) was used to measure the responses of the sample participants. To determine the scale of the resulting arithmetic means, the researcher adopted the following criteria for interpreting the scores:

- 1.00–1.80 = very low, 1.81–2.60 = low, 2.61–3.40 = average
- 3.41–4.20 = high score, 4.21–5.00 = very high score.

Fieldwork procedures

- The researcher distributed the questionnaires to members of the primary study sample, using two methods of distribution: Direct distribution (face-to-face) to those geographically accessible, and electronic distribution through Google Forms to remote areas.
- The response rates of the sample participants were monitored, the completed questionnaires were collected, and the data were then transcribed in preparation for the statistical analysis phase.

PRESENTATION, ANALYSIS, AND DISCUSSION OF RESULTS

This chapter presents and discusses the findings of the study following their field application and statistical analysis. The following is a detailed presentation of the answers to the study's questions:

With Regard to the First Objective the Study Sought to Achieve, Namely

(to identify the main obstacles facing the implementation of the PE program in state secondary schools in Iraq from the teachers' perspective).

To achieve the first objective, arithmetic means and standard deviations were calculated for the availability of the dimensions and items in the questionnaires assessing the PE program in state secondary schools in Iraq, as shown in Table 8:

Table 9 shows that the arithmetic mean for the availability score of the indicators in the axis assessing the obstacles facing the implementation of the PE program was (2.3864), indicating a low level of availability. The statement (1) (The school management's lack of interest in the PE program does not hinder its implementation) ranked first with an arithmetic mean of (2.55), a standard deviation of (0.893) and a low level of importance, while the statement (4) ("A lack of financial resources and sports equipment does not hinder the implementation of the physical education program") ranked last, with a mean of (2.06), a standard deviation of (0.985) and a low level of importance.

Statement (1) suggests that the sample participants view the administrative aspect (despite its weakness) as the least hindering factor for the program compared to the other factors; furthermore, the statistical data reveal a high degree of homogeneity and consistency in the sample's responses regarding this view, as is evident from statement (4), which came last in the ranking, the very low score indicates a strong inverse correlation, as the sample members agree that a lack of resources and material equipment is the greatest and most fundamental obstacle hindering the program's implementation (implicitly rejecting the idea that it does not pose an obstacle).

This can be explained through "Systems Theory" in educational management, which holds that any program (outputs) depends on (inputs) and processes. The inputs: The result (2.38) indicates a shortfall in inputs (budget, sports equipment, and regulation-compliant sports grounds in Iraqi state schools); pupil density in Iraqi state schools may play a role in reducing the effectiveness of the PE program.

The researcher attributes this to the PE program facing a hostile environment rife with practical obstacles that limit its effectiveness. The statistical findings show that the crisis in program implementation is primarily a logistical and material one, rather than an administrative or organizational one, which

Table 8: The arithmetic means, standard deviations, degree of availability, and ranking of the items for the dimension (Assessment of obstacles facing the implementation of the PE program)

Axis 6: Assessment of obstacles facing the implementation of the PE program (11 Items)						
No.	Items	N	Mean	Std. D	AS	RS
F1	The school management's lack of interest in the PE program does not hinder its implementation	376	2.55	0.893	L	1 st
F5	The limited number of training courses available to PE teachers adequately meets their professional needs.		2.54	0.848	L	2 nd
F10	The fact that some PE teachers do not have academic qualifications does not hinder the implementation of the program.		2.53	0.867	L	3 rd
F11	The lack of ongoing training programs to develop teachers' skills does not affect the quality of the program's delivery.		2.51	0.855	L	4 th
F6	The negative attitude of some teachers and pupils toward PE is not an obstacle to the implementation of the program.		2.49	1.017	L	5 th
F2	Large class sizes do not hinder the delivery of the PE program.		2.47	0.894	L	6 th
F7	A lack of parental cooperation in supporting the PE program does not hinder its implementation.		2.38	0.853	L	7 th
F3	The PE timetable achieves its objectives and meets the pupils' needs.		2.30	0.830	L	8 th
F8	A lack of human resources does not hinder the implementation of the PE program.		2.24	0.934	L	9 th
F9	The lack of incentives for outstanding teachers and students excelling in sport does not hinder the implementation of the program.		2.19	0.995	L	10 th
F4	A lack of financial resources and sports facilities does not hinder the implementation of the PE program.		2.06	0.985	L	11 th
Axis overall average			2.3864	0.63884	L	

Std. D: Standard deviation, AS: Availability score, RS: Rank of statement, PE: Physical education

calls for financial support to be directed toward providing equipment and sports grounds as a top priority.

The findings of this study were consistent with those of Al-Jizani and Al-Salamy (2025), which showed that a lack of managerial attention, coupled with a shortage of equipment, are the most significant factors affecting school sport, this supports the high score for statement (1). Furthermore, the results showed that material and technical constraints ranked first among the obstacles, while organizational constraints ranked lower; this is fully consistent with the low score for statement (4) in the present study.

The findings of this study are consistent with a body of Iraqi and Arab research, such as the study by Al-Sa'adi (2018), which indicated that the constraints on PE in Iraq are concentrated in the "material aspect" and a lack of sports grounds and equipment, which explains why the arithmetic mean remains at critical levels; and the study by Hardman (2008): In his global survey of PE, he confirmed that in countries experiencing economic instability, sports programs suffer from marginalization in favor of academic subjects, leading to low assessment scores in terms of implementation.

The findings of this study differed from those of Kaddour and Tahir (2025), who indicated that a lack of managerial attention

was the most significant influencing factor; this contrasts with statement (1), which ranked first. The findings also differed from those of Casey and Kirk (2021), in which "lack of material resources" no longer represented a major obstacle; rather, the obstacles had shifted to "insufficient time allocated to lessons," "excessive focus on academic examinations," or "teachers' lack of technological skills," which implies that in developed countries, the financial issue has been resolved; this contrasts with statement (4), which ranked last.

With Regard to the Second Objective that the Study Sought to Achieve, Namely

Ranking obstacles according to their degree of impact on program implementation (professional, material, human, and administrative).

Based on the table above, a brief explanation of the ranking of obstacles according to the highest arithmetic mean (rather than by the order of individual Items), with an academic analysis of the root causes for each dimension. This result indicates that school headteachers are aware of fundamental barriers hindering the implementation of the PE program, and that these barriers encompass professional, material, human, and administrative dimensions in an integrated manner. These barriers will be discussed below according to the four required classifications.

Table 9: The arithmetic means, standard deviations, degree of availability, and ranking of the statements for the axis (Assessment of obstacles facing the implementation of the PE program)

Items in the axis (11)							
No.	Items	n	Mean	Std D	DI (%)	DA	RS
Career obstacles		376					
F5	The limited number of training courses available to PE teachers adequately meets their professional needs.		2.54	0.848	50.8	Low	First
F10	The fact that some PE teachers do not have academic qualifications does not hinder the implementation of the program.		2.53	0.867	50.6	Low	Second
F11	The lack of ongoing training programs to develop teachers' skills does not affect the quality of the program's delivery.		2.51	0.855	50.2	Low	Third
Domain score			2.53	0.857	50.6	Low	
Physical barriers			Mean	Std D	DI	DA	RS
F4	A lack of financial resources and sports facilities does not hinder the implementation of the PE program.		2.06	0.985	41.2	Low	First
Human constraints			Mean	Std D	DI (%)	DA	RS
F6	The negative attitude of some teachers and pupils toward PE is not an obstacle to the implementation of the program.		2.49	1.017	49.8	Low	First
F2	Large class sizes do not hinder the delivery of the PE program.		2.47	0.894	49.4	Low	Second
F7	A lack of parental cooperation in supporting the PE program does not hinder its implementation.		2.38	0.853	47.6	Low	Third
F8	A lack of human resources does not hinder the implementation of the PE program.		2.24	0.934	44.8	Low	Fourth
Domain score			2.40	0.925	48	Low	
Administrative barriers			Mean	Std D	DI (%)	DA	RS
F1	The school management's lack of interest in the PE program does not hinder its implementation		2.55	0.893	51	Low	First
F3	The PE timetable achieves its objectives and meets the pupils' needs.		2.30	0.830	46	Low	Second
F9	The lack of incentives for outstanding teachers and pupils excelling in sport does not hinder the implementation of the program.		2.19	0.995	43.8	Low	Third
Domain score			2.35	0.906	47	Low	
Axis of the obstacles facing the implementation of the PE program			2.3864	0.63884	47.6	Low	

DI: Degree of impact, DA: Degree of availability, RS: Rank of the item, PE: Physical education, Std S: Stanard deviation

Firstly: Professional barriers (highest impact)

These ranked highest because they directly affect the teacher's professional identity (performance competence, incentives, and planning). Teachers feel that the lack of continuous professional development and the absence of a rewarding incentive system limit their ability to innovate in the classroom; this is an internal feeling that is more acute than external problems (such as equipment or management).

Human nature means that teachers are more psychologically affected by a lack of moral and material recognition than by

a shortage of resources, as they feel that their efforts are not valued.

This finding is consistent with the conclusions of UNESCO's global reports; the report *The Global State of Play* (UNESCO and Loughborough University, 2024) that inadequate professional training for PE teachers is considered one of the most significant global challenges in implementing high-quality PE programs, based on data collected from 117 countries involving 2,455 teachers. Furthermore, a study by Williams *et al.* (2025) confirmed that teachers face multiple

challenges in their professional development, the most prominent of which are time constraints and an administrative workload that limits their ability to engage in school-based professional learning programs.

A study by Richards *et al.* (2024) highlighted the scarcity of professional development programs specializing in PE, leading to teachers feeling marginalized and that their professional status is low. Furthermore, a study by Lux, Gaudreault, and Woods (2025) found that PE teachers suffer from professional and social isolation as a result of the lack of professional development tailored to their field, creating a self-perpetuating cycle of marginalization and career stagnation.

Secondly: Material constraints

This finding stems from the fact that material resources represent an essential and irreplaceable element of PE, as it relies on facilities, spaces, and equipment that cannot be compensated for by general increases in the education budget. This suggests that the teachers in this sample have adapted to the scarcity of resources, or that they regard the lack of equipment as a long-standing, expected problem that does not constitute a major psychological barrier compared to the professional challenges that weigh heavily on them on a daily basis. A recent study in China (2026) showed that 75 out of 107 provinces fell into the “very low” and “low” resource categories on the PE Resource Adequacy Index, with patterns of scarcity persisting in peripheral regions. The same report also highlighted that funding, human resources, and infrastructure function as complementary inputs rather than independent substitutes, meaning that a shortfall in one of these elements negatively affects the effectiveness of the others.

Third: Human constraints

This finding reflects that the human factor represents a barrier of moderate importance compared to professional and material barriers, yet it is no less influential. Studies indicate that PE suffers from institutional disparagement, leading to its marginalization compared to other academic subjects. A study by Williams *et al.* (2025) found that PE teachers operate within interdependent relationships with senior management, in which the balance of power favors the administration. This leads to the marginalization of PE through the provision of practical facilities only, without the allocation of theoretical lessons, and limits teachers’ autonomy and their ability to teach.

Fourth: Administrative barriers

This suggests that administrative support is inconsistent; while teachers complain about the administration’s shortcomings in certain areas (such as equipment), they perceive that other administrative aspects (such as guidance and timetabling) do not

significantly affect them, or that the administration intervenes positively in other areas, thereby lowering the overall score for this dimension. The high score for the professional dimension confirms that the human factor (teachers’ psychological state and self-efficacy) is the greatest challenge, rather than material or organizational factors, which calls for the implementation of psychological and professional support programs for teachers before the purchase of equipment.

This finding suggests that the role of school management is pivotal to the success or failure of a PE program. A study by Kwon *et al.* (2024) concluded that headteachers’ prior upbringing and personal theories shape their support for PE, and that tensions escalate when headteachers’ values and beliefs differ from those of PE teachers. The same study also showed that school and policy constraints influence headteachers’ perspectives on and support for PE.

In a study by Song *et al.* (2026) on headteachers’ attitudes toward online PE, it was found that headteachers expressed negative views toward the PE lessons delivered by teachers; furthermore, headteachers lacked focus and interest in the future of PE. A study by Saeed *et al.* (2025) indicated that the role of school management in providing the necessary resources to facilitate school sports activities was weak.

CONCLUSION

Based on the findings, the researcher reached a number of conclusions:

1. Teachers consider the program’s impact on actual teaching practice to be limited and relatively weak, attributable to various practical obstacles (lack of resources, lack of sports grounds, and inadequate training)
2. This conclusion reflects a gap between design and implementation in the field, as the efforts made by teachers do not have a sufficient impact on improving the program’s outcomes
3. There is a theoretical framework for the PE program, but it has not been carefully considered and does not take into account individual differences amongst pupils, as it lacks flexibility and has not been updated in line with modern educational developments
4. PE programs should be restructured in line with modern educational standards, with a focus on the areas of development and assessment, which recorded the lowest levels of implementation
5. Implementation is carried out in a routine, traditional manner without innovation or renewal in teaching methods, as the current educational assessment system is ineffective and does not accurately measure learning outcomes
6. The current content does not meet students’ developmental needs nor does it align with the demands of the modern

world, due to the almost complete absence of development and updating processes within the program.

RECOMMENDATIONS

Based on the study's findings regarding the ranking of obstacles, the researcher recommends the following:

1. Upgrading infrastructure: The Iraqi Ministry of Education must draw up an urgent national plan to renovate sports grounds and halls in state secondary schools.
2. The researcher recommends allocating a fixed annual budget to each school under the heading 'sports activity expenditure' to ensure a continuous supply of sports equipment and apparatus
3. Organizing workshops for secondary school headteachers to raise awareness of the importance of PE lessons, to reduce the administrative gap identified by the findings as a barrier of moderate impact
4. Continuing professional development: PE teachers should be required to undertake regular training courses on modern teaching strategies, given the current lack of resources
5. The researcher recommends the design of a specific PE curriculum for state secondary schools in Iraq, based on field observations made by the researcher through his professional experience in the field
6. Conduct an annual assessment of implementation barriers using international quality standards such as the UNESCO QPE to ensure that physical performance in state schools does not decline
7. Supervising staff should provide mentoring and guidance programs for new teachers to facilitate the exchange of experiences amongst teaching staff
8. Promote regular field visits to schools, focusing on qualitative rather than quantitative monitoring, and establish effective channels of communication between supervisors and teachers to convey challenges and obstacles and propose solutions. This is to document challenges and obstacles encountered in the field and report them to senior management on a regular and systematic basis
9. Strengthen partnerships with external bodies (the Ministry of Youth and Sport, sports clubs, universities) to support the program
10. Launch national initiatives to raise awareness of the importance of PE in school health through preventive and therapeutic programs aimed at building a healthy generation
11. Establish a national database of school PE performance indicators to promote scientific research in the field of school PE and support researchers within the Ministry of Education
12. Involve parents in supporting PE programs through awareness-raising sessions.

SUGGESTIONS: (SUGGESTIONS FOR FUTURE RESEARCH)

- Identify the barriers to implementing the PE program in state and private schools in Iraq
- Measuring the impact of the proposed training programs on mitigating the obstacles listed in the table.

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