
PSYCHOMETRIC DEVELOPMENT AND PRELIMINARY RELIABILITY OF THE DEFENSIVE TACTICS AWARENESS QUESTIONNAIRE IN HANDBALL

Mekala Ramakanth^{*1}, Prof. (Dr.) Indu Mazumdar²

¹PhD Scholar at School of Sports Education, ITM University Gwalior and Physical Director at Chinmaya Vidyalaya School Hyderabad.

²Dean, School of Sports Education, ITM University, Gwalior.

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***Corresponding Author: Mekala Ramakanth**

PhD Scholar at School of Sports Education, ITM University Gwalior and Physical Director at Chinmaya Vidyalaya School Hyderabad.

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ABSTRACT

The present study aimed to examine the preliminary psychometric properties of the Defensive Tactics Awareness Questionnaire (DTAQ), a self-designed 45-item instrument developed to assess perceived defensive tactical awareness among competitive handball players. The questionnaire was structured across seven theoretically derived domains: Systems Knowledge, Positional Discipline, Communication, Decision Making, Transition Awareness, Opponent Analysis, and Psychological Resilience. Following expert content validation, the instrument was administered to 25 university- and state-level handball players on two occasions separated by a 10-day interval. Descriptive statistics, Cronbach's alpha, corrected item-total correlations, alpha if item deleted, and test-retest reliability were calculated to evaluate the scale's preliminary psychometric quality. The results showed that five of the seven domains demonstrated acceptable to good internal consistency, with Cronbach's alpha values ranging from 0.72 to 0.89. Positional Discipline showed the strongest internal consistency, whereas Communication and Psychological Resilience displayed weaker reliability and require further refinement. Test-retest analysis indicated good temporal stability across the scale, with the overall DTAQ showing a Pearson correlation of 0.74 between the two administrations. These findings suggest that the DTAQ has promising potential as a multidimensional tool for assessing defensive tactical awareness in handball players, although additional item revision and validation in larger, more diverse samples are

needed before broader application. The study provides an initial foundation for future research on tactical awareness assessment in handball and contributes to the development of sport-specific psychometric instruments.

KEYWORDS: Handball, Tactical Awareness, Questionnaire Development, Psychometrics, Reliability, Test–Retest, Defensive Performance.

INTRODUCTION

Handball is a high-intensity team sport in which performance emerges from the interaction of physical conditioning, technical execution, tactical adaptation, and psychological readiness. Within this performance structure, defensive play is especially dependent on rapid perception, efficient decision making, positional organization, anticipation of offensive patterns, and coordinated communication among teammates (*Bonnet et al., 2020*). Because defensive success in handball is rarely attributable to a single action, athletes must continuously interpret dynamic game situations and respond within a collective tactical framework (*Bonnet et al., 2020; Marquina et al., 2023*).

Recent handball research has highlighted the importance of perceptual-cognitive expertise in distinguishing higher-performing players from less experienced performers. Decision making, situational reading, and adaptive tactical behavior are now recognized as central components of performance in invasion games, including handball (*Bonnet et al., 2020*). At the same time, advances in observational game analysis have provided more sophisticated ways to study tactical behavior, including tools capable of quantifying individual and collective actions during competition (*Marquina et al., 2023*). However, these approaches often require technical expertise, extensive coding time, and substantial analytical resources, which may limit their practicality in pilot studies, educational settings, or field-based athlete assessment.

In this context, self-report instruments may provide a useful complementary approach for examining athletes' perceived tactical awareness. Although self-report measures cannot replace observational or performance-based analysis, they can offer structured insight into how players understand defensive systems, interpret match situations, communicate tactical information, and respond psychologically under pressure (*Bonnet et al., 2020*). In sports psychometrics, newly developed questionnaires are typically introduced through a staged process that includes item generation, expert review, pilot testing, and preliminary reliability analysis before broader construct validation is attempted (*Liu et al., 2024*).

Despite the growing body of research on handball performance, a brief multidimensional self-report instrument specifically designed to assess defensive tactical awareness across several key domains was not clearly identified in the recent literature reviewed for the present study. Existing studies have tended to focus either on observational performance analysis or on isolated cognitive and tactical variables rather than on a comprehensive athlete-reported measure of defensive awareness (*Bonnet et al., 2020; Marquina et al., 2023*). This represents an important gap, as coaches and researchers may benefit from a practical instrument that captures players' perceptions of their defensive understanding across different tactical dimensions.

To address this need, the present study developed the **Defensive Tactics Awareness Questionnaire (DTAQ)**, a 45-item self-designed instrument intended to assess perceived defensive tactical awareness among competitive handball players. The questionnaire was organized into seven theoretically derived domains: Systems Knowledge, Positional Discipline, Communication, Decision Making, Transition Awareness, Opponent Analysis, and Psychological Resilience. These domains were selected to reflect the multidimensional nature of handball defense, which requires not only tactical knowledge and decision competence but also effective coordination, situational awareness, and emotional control under competitive pressure (*Bonnet et al., 2020*).

Accordingly, the purpose of the present pilot study was to examine the preliminary psychometric properties of the DTAQ among university- and state-level handball players. Specifically, the study sought to assess the internal consistency of each domain and the instrument's temporal stability over a 10-day interval. It was expected that the findings would provide an initial foundation for further refinement and larger-scale validation of the DTAQ as a sport-specific measure of defensive tactical awareness (*Liu et al., 2024; Marquina et al., 2023*).

METHODOLOGY

Research Design

The present study employed an instrument development and pilot psychometric design to examine the preliminary reliability of the Defensive Tactics Awareness Questionnaire (DTAQ). Pilot validation is an important early stage in sport-specific scale development because it enables researchers to evaluate item functioning, domain coherence, and temporal stability before proceeding to more advanced construct validation procedures such as exploratory and confirmatory factor analysis (*Liu et al., 2024*). In line with contemporary

psychometric practice, the study focused on two central reliability indicators: internal consistency and test–retest stability (*Liu et al., 2024; Marquina et al., 2023*).

Participants

A total of 25 competitive handball players participated in the pilot study. The sample consisted of university- and state-level athletes drawn from different playing positions, thereby providing an appropriate context for the preliminary testing of a sport-specific tactical awareness instrument. The participants had a mean age of 22.20 years ($SD = 2.43$), mean playing experience of 6.48 years ($SD = 2.31$), and mean weekly training exposure of 12.44 hours ($SD = 3.10$). Because tactical awareness in handball is shaped by accumulated playing exposure, contextual perception, and competitive experience, this sample was considered suitable for an initial psychometric assessment (*Bonnet et al., 2020; Marquina et al., 2023*).

Instrument Development

The DTAQ is a self-designed questionnaire developed to assess perceived defensive tactical awareness in handball players. The instrument contains 45 items scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The item pool was distributed across seven theoretically derived domains: Systems Knowledge, Positional Discipline, Communication, Decision Making, Transition Awareness, Opponent Analysis, and Psychological Resilience. The multidimensional structure of the questionnaire was informed by the tactical and perceptual-cognitive demands of handball defense, which require coordinated positioning, adaptive decision making, shared tactical understanding, and the ability to remain effective under competitive pressure (*Bonnet et al., 2020*).

Content Validation

Before pilot testing, the questionnaire underwent expert review for content validation. Content validation is a standard step in instrument development because it helps determine whether items are conceptually relevant, clearly worded, and representative of the intended domains (*Liu et al., 2024; Marquina et al., 2023*). In the present study, the item pool was reviewed by experts in handball, sports sciences, and related areas prior to administration. However, numerical indices such as the Content Validity Index were not available in the present dataset and therefore were not reported.

Pilot Study Procedure

The DTAQ was administered to the same participants on two occasions separated by a 10-day interval. The first administration was used to assess item-level performance and internal consistency, while the second administration was used to evaluate temporal stability. A short retest interval is often recommended in preliminary reliability studies because it reduces the likelihood of genuine change in the construct while still allowing an assessment of the consistency of responses across time (*Liu et al., 2024*). The 10-day interval used in the present study was therefore considered appropriate for pilot reliability testing.

Statistical Analysis

Descriptive statistics were calculated for participant demographics and each DTAQ domain, including mean, standard deviation, minimum, and maximum values. Internal consistency was assessed using Cronbach's alpha coefficient for each of the seven domains. In accordance with common psychometric interpretation, alpha values around 0.70 or above were considered acceptable for a newly developed instrument, while higher values indicated better internal consistency (*Liu et al., 2024; Marquina et al., 2023*). Test-retest reliability was estimated using Pearson's correlation coefficient between the first and second administrations, with higher coefficients indicating stronger temporal stability. These analyses were selected because they are widely used in early-stage reliability studies of self-report measures in sport and exercise settings (*Liu et al., 2024; Marquina et al., 2023*).

RESULTS

Participant Characteristics

A total of 25 university and state-level handball players participated in the pilot study conducted to examine the preliminary psychometric properties of the Defensive Tactics Awareness Questionnaire (DTAQ). The sample included athletes from different playing positions and competition levels, which is appropriate for an initial validation attempt in a handball-specific measurement context (*Bonnet et al., 2020; Marquina et al., 2023*). The participants had a mean age of 22.20 years ($SD = 2.43$), a mean playing experience of 6.48 years ($SD = 2.31$), and an average weekly training duration of 12.44 hours ($SD = 3.10$), indicating that the sample represented moderately experienced competitive players (*Liu et al., 2024*).

Table 1: Demographic Characteristics of the Participants. (N = 25)

Variable	Mean $\pm$ SD
Age (years)	22.20 $\pm$ 2.43
Playing experience (years)	6.48 $\pm$ 2.31
Training hours per week	12.44 $\pm$ 3.10

Table 1 indicates that the pilot participants were relatively young but experienced players with regular weekly training exposure. This profile is suitable for preliminary item testing, although the modest sample size limits the stability of the reliability estimates and the generalizability of the findings (Liu et al., 2024).

Internal Consistency Reliability

The internal consistency of the seven DTAQ domains was evaluated using Cronbach's alpha. The findings revealed acceptable to good internal consistency for five of the seven domains, with alpha coefficients ranging from 0.72 to 0.89. Positional Discipline demonstrated the highest internal consistency ($\alpha = 0.89$), followed by Transition Awareness ($\alpha = 0.85$) and Decision Making ($\alpha = 0.81$), indicating strong internal coherence among the items within these domains (Bonnet et al., 2020; Marquina et al., 2023).

Systems Knowledge ($\alpha = 0.76$) and Opponent Analysis ($\alpha = 0.72$) also showed acceptable reliability and met the recommended threshold for newly developed instruments. In contrast, Communication ($\alpha = 0.52$) showed relatively weak internal consistency, while Psychological Resilience ($\alpha = 0.61$) demonstrated questionable reliability. These results suggest that the item content within these two domains may require refinement before the questionnaire can be considered psychometrically robust (Liu et al., 2024).

Table 2 Descriptive Statistics and Internal Consistency of the DTAQ.

Domain	Items	Mean	SD	Min	Max	Cronbach's α	Interpretation
Systems Knowledge	8	31.64	2.43	27	37	0.76	Acceptable
Positional Discipline	9	36.16	2.44	29	40	0.89	Good
Communication	8	32.32	2.38	26	37	0.52	Poor
Decision Making	7	28.36	2.00	24	32	0.81	Good
Transition Awareness	5	20.52	1.42	17	24	0.85	Good
Opponent Analysis	4	16.68	1.63	14	20	0.72	Acceptable
Psychological Resilience	4	15.80	1.22	13	18	0.61	Questionable

Table 2 shows that the DTAQ performed unevenly across its domains. The strongest coefficients were observed for Positional Discipline, Decision Making, and Transition Awareness, which is conceptually consistent with the importance of structured tactical organization and rapid adjustment in handball defense (Bonnet et al., 2020; Marquina et al., 2023). By contrast, the weaker alpha values for Communication and Psychological Resilience suggest that these domains may be more heterogeneous or may not yet be fully captured by the current items (Liu et al., 2024).

Test–Retest Reliability

To examine temporal stability, the DTAQ was administered twice with a 10-day interval, and Pearson’s correlation coefficient was computed for each domain. The results demonstrated moderate to very good test–retest reliability across all domains. Opponent Analysis showed the highest stability ($r = 0.87$), followed by Communication ($r = 0.83$), indicating very good temporal consistency. Positional Discipline ($r = 0.73$) and Decision Making ($r = 0.71$) also showed good stability, whereas Systems Knowledge ($r = 0.67$), Transition Awareness ($r = 0.69$), and Psychological Resilience ($r = 0.64$) reflected moderate stability (Liu et al., 2024; Marquina et al., 2023).

The overall DTAQ showed a test–retest reliability coefficient of $r = 0.74$, indicating good temporal stability. This suggests that the questionnaire provides reasonably consistent scores over time, even though internal consistency is not equally strong across all domains. In psychometric terms, this pattern indicates that the instrument is stable across administrations but still requires item-level refinement to improve domain coherence (Liu et al., 2024).

Table 3 Test–Retest Reliability of the DTAQ.

Domain	Pearson’s r	Interpretation
Systems Knowledge	0.67	Moderate
Positional Discipline	0.73	Good
Communication	0.83	Very good
Decision Making	0.71	Good
Transition Awareness	0.69	Moderate
Opponent Analysis	0.87	Very good
Psychological Resilience	0.64	Moderate
Overall DTAQ	0.74	Good

Table 3 indicates that the DTAQ scores were reproducible across the 10-day interval, especially in the Communication and Opponent Analysis domains. This temporal stability is

an encouraging early sign for a newly developed sport-specific questionnaire, because reliable repeated measurement is a prerequisite for later validity work such as factor analysis and criterion comparison (*Bonnet et al., 2020; Marquina et al., 2023*).

Summary of Preliminary Validation

Overall, the pilot findings provide encouraging initial evidence for the psychometric quality of the DTAQ. Five of the seven domains demonstrated acceptable to good internal consistency, while the remaining two domains showed lower coefficients and therefore need further refinement. Test–retest analysis indicated moderate to very good temporal stability across all domains, with the overall questionnaire showing good consistency over time (*Liu et al., 2024*).

Collectively, these findings support the DTAQ as a promising multidimensional tool for assessing defensive tactical awareness in handball players. However, additional psychometric evaluation with a larger and more diverse sample is necessary before the questionnaire can be considered fully validated for broader research and applied sport settings (*Bonnet et al., 2020; Marquina et al., 2023; Liu et al., 2024*).

DISCUSSION

The purpose of the present pilot study was to examine the preliminary reliability of the Defensive Tactics Awareness Questionnaire among competitive handball players. The findings indicate that the instrument demonstrates promising psychometric potential, particularly in relation to temporal stability and the internal consistency of several key domains. More specifically, five of the seven domains showed acceptable to good Cronbach's alpha values, while the overall pattern of test–retest coefficients suggested moderate to very good stability across time. Taken together, these findings provide preliminary support for the DTAQ as a multidimensional measure of perceived defensive tactical awareness in handball (*Bonnet et al., 2020; Liu et al., 2024*).

Among the seven domains, Positional Discipline, Decision Making, and Transition Awareness emerged as the strongest in terms of internal consistency. This pattern is conceptually meaningful because these domains reflect core aspects of defensive behavior in handball, including spatial organization, tactical adjustment, and rapid response to offensive change. Contemporary handball literature has emphasized that high-level performance depends heavily on the capacity to interpret game situations quickly and to coordinate decisions within a dynamic team structure (*Bonnet et al., 2020*). The strong reliability of

these domains therefore suggests that the underlying items were relatively coherent in capturing tactically central dimensions of handball defense.

Systems Knowledge and Opponent Analysis also demonstrated acceptable internal consistency, indicating that these domains may already possess a satisfactory item structure for early-stage instrument development. These findings are encouraging because knowledge of defensive systems and the ability to identify opponent tendencies are both integral to tactical competence in invasion games. In recent handball performance research, tactical understanding has increasingly been framed as a combination of situational perception, analytical interpretation, and context-sensitive action selection (*Bonnet et al., 2020; Marquina et al., 2023*). From this perspective, the acceptable reliability of these two domains supports their continued inclusion in subsequent phases of DTAQ refinement.

In contrast, the Communication and Psychological Resilience domains demonstrated weaker internal consistency, with alpha coefficients of 0.52 and 0.61, respectively. These lower values suggest that the items in these domains may not yet represent sufficiently homogeneous constructs. One possible explanation is that both communication and resilience are broad, context-dependent constructs that may involve multiple subcomponents. For example, communication in handball can include verbal cues, non-verbal signaling, anticipatory coordination, and real-time tactical correction, while psychological resilience may involve confidence recovery, attentional control, emotional regulation, and trust in teammates. When such multidimensional constructs are measured with a small number of items, internal consistency may be attenuated unless item wording is highly focused and conceptually aligned (*Liu et al., 2024*).

Despite the variability in internal consistency across domains, the test–retest findings were generally encouraging. All seven domains demonstrated moderate to very good stability over the 10-day interval, and the overall DTAQ showed good temporal reliability. This suggests that the questionnaire yields reasonably consistent responses over time and that participants interpreted the items in a stable manner across repeated administrations. In psychometric terms, temporal stability is a valuable early indicator because it supports the reproducibility of the measurement process, even when some domains still require item revision (*Liu et al., 2024; Marquina et al., 2023*).

The strongest test–retest coefficients were observed for Opponent Analysis and Communication. This finding may reflect the fact that athletes' perceptions of opponent-reading ability and team communication tendencies are relatively stable over short periods, especially within ongoing training or competitive environments. In handball, the ability to

analyze opponents and exchange tactical information is deeply embedded in repeated match preparation and shared team structure, which may contribute to stable self-perceptions in these areas (*Bonnet et al., 2020; Marquina et al., 2023*).

The present findings should be interpreted as preliminary rather than definitive. The most important limitation is the small sample size, which restricts generalizability and prevents more advanced psychometric analyses such as exploratory factor analysis or confirmatory factor analysis. In addition, the sample was relatively homogeneous in terms of competitive background, which may have limited score variability and influenced reliability coefficients. Recent psychometric studies in sport have shown that larger and more diverse samples are essential for establishing factor structure, discriminant validity, and broader applicability of newly developed instruments (*Liu et al., 2024*).

Even with these limitations, the present study provides an important first step in the development of a handball-specific questionnaire focused on defensive tactical awareness. Existing research has paid considerable attention to tactical decision making and observational analysis in handball, yet there remains a lack of concise multidimensional self-report measures designed specifically for defensive tactical constructs (*Bonnet et al., 2020; Marquina et al., 2023*). The DTAQ addresses this gap by offering a theoretically grounded framework that can be refined and expanded in future validation work.

Future research should focus on revising weaker items, especially in the Communication and Psychological Resilience domains, and re-evaluating the instrument in a larger sample that includes athletes from different competitive levels, age groups, and tactical systems. Subsequent studies should also examine construct validity through factor analysis and investigate criterion-related validity by comparing DTAQ scores with coach ratings, observational performance measures, or tactical decision-making assessments. Such steps would provide stronger evidence regarding whether the instrument accurately captures defensive tactical awareness in applied handball settings (*Bonnet et al., 2020; Liu et al., 2024; Marquina et al., 2023*).

Need and Significance of the Study

In modern handball, defensive effectiveness depends not only on physical preparedness and technical execution but also on tactical understanding, coordinated positioning, anticipatory decision making, and collective communication. Recent literature has emphasized that these perceptual-cognitive and tactical components are central to performance, yet they remain difficult to assess using practical field-based tools (*Bonnet et al., 2020*). Although

observational systems can provide rich tactical data, they often require trained analysts, structured coding procedures, and considerable time investment, which may not be feasible in many university, developmental, or applied sport settings (*Marquina et al., 2023*).

A multidimensional questionnaire focusing specifically on defensive tactical awareness may therefore provide a useful complementary approach for coaches, researchers, and sport psychologists. Such an instrument can help identify how players perceive their own knowledge of defensive systems, positional organization, communication behavior, decision-making quality, transition responses, opponent reading, and resilience under match pressure. In applied settings, this type of information may assist in player profiling, targeted feedback, and the planning of tactical education programs, especially when direct observational assessment is unavailable or impractical (*Bonnet et al., 2020; Marquina et al., 2023*).

The significance of the present study lies in its attempt to develop and preliminarily evaluate a handball-specific instrument that addresses an underexplored area of tactical assessment. Recent psychometric work in sport has shown that the development of a useful questionnaire requires staged evidence, beginning with item design, content review, pilot administration, and preliminary reliability testing before construct validity is examined in larger samples (*Liu et al., 2024*). By undertaking this pilot evaluation, the present study provides an initial empirical basis for refining the DTAQ and contributes to the broader effort to develop context-sensitive assessment tools in sport science and performance research (*Liu et al., 2024; Marquina et al., 2023*).

CONCLUSION

The present pilot study was conducted to examine the preliminary psychometric properties of the Defensive Tactics Awareness Questionnaire among competitive handball players. The findings showed that five of the seven domains demonstrated acceptable to good internal consistency, while two domains—Communication and Psychological Resilience—displayed weaker reliability and therefore warrant further refinement. In addition, test–retest results indicated moderate to very good temporal stability across domains, with the overall questionnaire demonstrating good consistency over the 10-day interval (*Liu et al., 2024*).

These findings suggest that the DTAQ has promise as a multidimensional instrument for assessing perceived defensive tactical awareness in handball. The strongest results were observed in domains closely related to core tactical functioning, such as Positional Discipline, Decision Making, and Transition Awareness, which aligns with current understanding of the importance of perceptual-cognitive and tactical processes in handball performance (*Bonnet et*

al., 2020). At the same time, the weaker-performing domains indicate that the instrument remains in an early developmental stage and should not yet be treated as fully validated for wider research or applied use.

Overall, the study provides an encouraging first step toward the construction of a handball-specific tactical awareness questionnaire. Further research involving larger and more diverse samples, item refinement, and more advanced psychometric analyses will be necessary to establish the construct validity and broader applicability of the DTAQ. Even so, the present findings support continued development of the instrument and highlight its potential relevance for handball coaching, athlete assessment, and sport science research (*Bonnet et al.*, 2020; *Liu et al.*, 2024; *Marquina et al.*, 2023).

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