

A Correlational Study of Table Tennis Skill Level with Anthropometric Measurements and Aggression among Participating High School Inter-College Girl Table Tennis Players

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Abstract

*This paper outlines a rigorous correlational study designed to investigate the relationship between **Table Tennis Skill Level (TTSL)** and two distinct performance domains: **Anthropometric Measurements** (body size and composition) and **Aggression** (a psychological trait) among High School Inter-College Girl Table Tennis Players (aged 15–18 years). Based on the demands of the sport, it is hypothesized that superior TTSL will correlate with an optimal body composition (lower body fat, higher lean mass) and a controlled, positive form of competitive aggression. The study's anticipated findings will provide valuable data for coaches to refine talent selection criteria and develop integrated physical and psychological training strategies for young female table tennis athletes.*

1. Introduction and Background

Table tennis is recognized globally as a high-velocity, precision sport requiring intense mental focus and rapid, explosive motor actions. For high-level performance, the athlete must possess not only refined technical skills and tactical knowledge but also specific physical and psychological attributes that enable consistent execution under pressure.

The high school inter-college level (typically ages 15–18) represents a crucial stage for competitive development, where natural ability is consolidated through specialized training. Within this competitive female cohort, the specific roles of body structure (Anthropometry) and psychological drive (Aggression) in determining success remain under-explored, particularly in non-Western competitive structures.

This research aims to quantify the degree to which variations in TTSL among these athletes can be explained by differences in their anthropometric profiles and competitive aggression levels. Understanding these relationships can lead to more efficient talent identification and individualized training plans.

1.1 Rationale for Key Variables

- 1. Anthropometric Measurements:** While table tennis is not overtly reliant on height or mass, body composition—specifically the ratio of {Lean Body Mass (LBM)} to {Body Fat Percentage (BF%)}- is critical. An optimal composition minimizes inertia during rapid lateral movements and maximizes the power-to-weight ratio for explosive strokes. Segment lengths (e.g., forearm length) are also relevant to the biomechanics of racket leverage.
- 2. Aggression:** In sports psychology, aggression, when channeled instrumentally, is a positive predictor of performance. {Instrumental Aggression} refers to goal-directed, non-hostile behavior (e.g., executing a risky, powerful attack), crucial for dominating a rally and maintaining a competitive edge. This psychological factor is often a differentiator between skilled and highly skilled players.

1.2 Objectives and Hypotheses

Objectives:

- To determine the strength of correlation between selected **Anthropometric Measurements** and TTSL.
- To determine the strength of correlation between measured **Aggression** (Instrumental

and Hostile) and TTSL.

3. To identify the best anthropometric and aggression-related predictors of TTSL through multiple regression.

Hypotheses:

- **H1 (Anthropometry):** TTSL will be significantly and negatively correlated with **Body Fat Percentage (BF%)** and positively correlated with **Lean Body Mass (LBM)**.
- **H2 (Aggression):** TTSL will be significantly and positively correlated with **Instrumental Aggression** but show a negligible or negative correlation with **Hostile Aggression**.

2. Review of Literature

2.1 The Role of Anthropometry in Racquet Sports

Racquet sports often favor athletes with a specific somatotype, generally characterized as lean, to maximize speed and agility. In table tennis, the need for quick, intermittent movements suggests that excess non-functional mass (body fat) is detrimental to performance.

- **Body Composition:** Studies involving high-level athletes across various sports consistently demonstrate that lower BF% and higher LBM are associated with better physical performance metrics (Toro et al., 2020). LBM in the legs is critical for footwork, and LBM in the upper body supports forearm and grip power.
- **Segment Lengths:** While less definitive than in tennis, forearm and hand size can influence the moment of inertia and the resulting speed and spin on the ball. Athletes with favorable biomechanical levers may have a slight advantage in power generation and reach.

2.2 Aggression and Psychological Determinants

Competitive success in sport is highly dependent on psychological readiness and control.

- **Instrumental vs. Hostile Aggression:** Literature differentiates between **Instrumental Aggression** (using force to achieve an objective without intent to harm) and **Hostile Aggression** (intent to injure or express anger). Elite athletes utilize instrumental aggression—the will to dominate and take risks—as a positive performance tool (Stephens, 2012). For table tennis, this

manifests in executing a decisive smash or push with maximum force when the opportunity arises.

- **The Age Effect:** In the high school age group, emotional regulation is still developing. Therefore, identifying whether an athlete channels competitive drive constructively (Instrumental) or detrimentally (Hostile) is a critical predictive factor for performance consistency. A player prone to hostile aggression may lose focus, resulting in unforced errors.

2.3 Interaction with Table Tennis Skill

TTSL is a composite of technical efficiency and tactical effectiveness. The hypothesized correlation suggests that the athlete's physical vehicle (Anthropometry) must be optimized to execute high-level techniques, while the psychological engine (Aggression) must be primed to sustain the necessary intensity and risk-taking during competitive play. The lack of a specific physical advantage must often be compensated for by superior skill and psychological fortitude.

3. Methodology

3.1 Study Design and Participants

- **Design: A Descriptive Correlational Design** will be utilized to quantify the linear relationships between the measured variables.
- **Participants {N}:** A target sample of {N} = 100 High School Inter-College Girl Table Tennis Players (aged 15–18 years) with verifiable competitive experience at the Latur division or state level.
- **Sampling: Purposive Sampling** ensures that the participants have a sufficient range of skill levels to allow for meaningful correlation analysis.
- **Ethical Compliance:** All procedures will adhere to ethical guidelines, securing informed consent from athletes and their parents/guardians /coaches.

3.2 Data Collection Tools and Procedures

All physical and psychological data will be collected in a standardized setting over two non-consecutive days to prevent fatigue bias.

3.2.1 Dependent Variable: Table Tennis Skill Level (TTSL)

A composite score will be used to ensure high validity:

Assessment Component	Measurement Method	Contribution to Total Score
Technical Accuracy	Standardized Multi-Ball Skill Test Battery (Forehand Drive, Backhand Loop, Push Control)	50%
Performance Efficiency	Footwork Efficiency (Time/Accuracy on T-Table Drill)	30%
Competitive Validation	Official Tournament Ranking / Coach Rating (5-point scale)	20%
Total TTSL Score	Composite Index Score (0-100)	100%

3.2.2 Independent Variable Set 1: Anthropometric Measurements

Measurements will be taken by a certified anthropometrist following standard protocols (e.g., ISAK):

- **Height, Weight, Body Mass Index (BMI):** Measured using a stadiometer and calibrated scale.
- **Body Composition:** Measured using **Bioelectrical Impedance Analysis (BIA)** or **Skinfold Calipers** to determine **Body Fat Percentage (BF%)** and **Lean Body Mass (LBM)**.
- **Somatotype:** Calculated (e.g., Heath-Carter method) to classify body shape (Endomorphy, Mesomorphy, Ectomorphy).
- **Segment Lengths:** Arm span, forearm length, and hand length (critical for stroke biomechanics).

3.2.3 Independent Variable Set 2: Aggression

Aggression will be measured via a self-report questionnaire administered under controlled, confidential conditions:

- **Competitive Aggression and Anger Scale (CAAS) or a similar validated instrument:** This scale reliably separates aggression into categories.

- **Instrumental Aggression Subscale (Goal-Oriented):** Measures the extent to which an athlete uses force or dominating strategies to win.
- **Hostile Aggression Subscale (Anger-Driven):** Measures intent to harm or uncontrolled emotional outbursts.

3.3 Statistical Analysis

Data analysis will be performed using SPSS or R statistical software.

1. **Descriptive Statistics:** Calculation of Mean, Standard Deviation, and range for all variables to characterize the sample.
2. **Bivariate Correlation: Pearson Product-Moment Correlation Coefficient {r}** will be computed between each independent variable and the composite TTSL score to test H1 and H2.
3. **Predictive Analysis: Stepwise Multiple Regression Analysis** will be conducted. This will establish which combination of anthropometric and aggression variables are the **strongest composite predictors** of TTSL, resulting in a predictive equation.
4. **Significance:** The level of significance for all tests will be set at $\{p < 0.05\}$.

4. Expected Results and Discussion

4.1 Discussion of Expected Correlational Findings

4.1.1 Anthropometric Variables

The most significant anthropometric findings are expected to revolve around body composition.

- **Body Fat Percentage (BF%):** A significant **negative correlation** $\{r\}$ -0.35 to -0.50) is anticipated. This confirms the notion that excess body fat is non-functional weight, which creates greater inertia that must be overcome during the high volume of rapid, short-distance movements required in table tennis.
- **Lean Body Mass (LBM):** A significant **positive correlation** $\{r\}$ 0.30 to 0.45) is expected. Higher LBM, especially in the core, legs, and forearm, contributes directly to the explosive power needed for lunges and powerful strokes, thereby supporting H1.
- **Segment Lengths and Somatotype:** Correlations for height, arm span, and somatotype are expected to be weak $\{r\} < 0.20$.

This suggests that **functional body composition** (LBM/BF%) is a much stronger predictor of skill than overall body size, meaning that elite training is more about sculpting the existing frame than selecting based on innate height.

4.1.2 Aggression Variables

The findings for aggression will be crucial for integrated training recommendations and are expected to strongly support H2.

- **Instrumental Aggression (IA):** A significant **positive correlation** $\{r\}$ 0.40 to 0.55) is anticipated. This indicates that highly skilled players utilize their competitive drive constructively, willing to take calculated risks and apply maximum intensity to secure a point, suggesting that IA is a key psychological discriminator of skill level.
- **Hostile Aggression (HA):** A negligible or weak **negative correlation** $\{r\}$ -0.10 to -0.25) is expected. Hostile or anger-driven reactions often lead to a loss of focus, poor shot selection, and unforced errors, which detracts from overall performance.

4.2 Interpretation of Multiple Regression Analysis

The multiple regression analysis will likely identify a composite model where an aggression variable and a body composition variable are the top predictors:

The variable with the highest standardized beta coefficient will be the strongest individual predictor. It is possible that Instrumental Aggression emerges as the strongest predictor, indicating that once a basic level of technical competence is met, the psychological drive is the ultimate factor separating high-level performers. The model's total variance explained $\{R^2\}$ is anticipated to be moderate ($R^2 > 0.40$), indicating that while these physical and psychological factors are significant, a large portion of skill variance is still explained by technical training, tactical knowledge, and other non-measured variables.

5. Conclusion and Implications

5.1 Key Conclusion

This correlational study will likely conclude that Table Tennis Skill Level among High School Inter-College Girl Players is significantly and

positively associated with a disciplined competitive temperament (Instrumental Aggression) and a favorable body composition (low Body Fat Percentage and high Lean Body Mass). This underscores the necessity of a holistic training approach that integrates psychological skill development with physical conditioning.

5.2 Theoretical Implications

The research provides empirical evidence that extends the understanding of performance determinants into the young female demographic. It specifically validates the theoretical distinction between instrumental and hostile aggression in the context of table tennis performance, demonstrating that aggressive intent, when controlled and goal-directed, is a hallmark of superior skill.

5.3 Practical Implications and Recommendations

The findings have direct actionable implications for coaching and talent identification:

1. **Integrated Training:** Coaches must integrate **Psychological Skills Training (PST)** to foster instrumental aggression. Sessions should focus on channeling competitive intensity constructively, managing anger, and utilizing a dominant mindset for shot execution.
2. **Physical Conditioning Focus:** The physical training regimen should prioritize **body composition management**. Strength and conditioning should be aimed at maximizing **Lean Body Mass** for power generation and minimizing **Body Fat Percentage** to enhance agility and speed.
3. **Talent Identification:** Selection criteria for aspiring players should include objective assessments of **BF%** and **Instrumental Aggression** alongside technical trials. These attributes are highly trainable and predictive of future performance potential.
4. **Baseline Data:** The established correlation coefficients and mean values for the sample group can serve as **benchmarks** for evaluating the progress of individual athletes and comparing them to high-performing peers.

6. Limitations and Future Research

6.1 Limitations of the Study

As a correlational study, the primary limitation is the inability to infer causality. A correlation only

establishes a statistical relationship (e.g., skilled players are more instrumentally aggressive); it does not prove that increasing aggression *causes* an increase in skill. Furthermore, the use of a self-report questionnaire for aggression introduces the potential for social desirability bias, where participants may answer questions in a way they perceive as socially or athletically desirable, rather than truthfully.

6.2 Future Research Directions

Future studies should build upon these correlational foundations to establish causative links and expand the predictive model:

1. **Intervention Studies:** Conduct a Randomized Control Trial (RCT) where an experimental group receives a specific, structured psychological skills training program (e.g., focused on emotional regulation and assertive shot-making) over a competitive season, to measure the direct impact on both Instrumental Aggression scores and TTSL.
2. **Longitudinal Study:** Follow the same cohort of female players for 3-5 years to determine if the anthropometric profile or the aggression level is a better long-term predictor of career success and progression to higher competition levels.
3. **Expanded Predictors:** Integrate the findings from this study with a measure of Physical Fitness (e.g., reaction time, agility) and Cognitive Function (e.g., decision-making speed) to create a more comprehensive {Multidimensional\ Performance\ Model}.

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Note: In a submission-ready research paper, every source referenced would appear in this list, and every item in this list would be cited within the body of the paper (e.g., as "Toro et al., 2020").