Library Progress International *Print version ISSN 0970 1052*
Vol.44 No. 3, Jul-Dec 2024: P. 16780-16788 *Online version ISSN 2320 317X*

Original Article *Available online at www.bpasjournals.com*

Dermatoglyphics And Athletic Talent: "Analyzing Thumb Fingerprint Ridge Counts In Junior Basketball Players"

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How to cite this article: Reena Joseph, Swathy K K, Nisha Philip, Binu George Varghese (2024) Dermatoglyphics And Athletic Talent: "Analyzing Thumb Fingerprint Ridge Counts In Junior Basketball Players". *Library Progress International,* 44(3), 16780-16788

Abstract
This study investigates the relationship between thumb fingerprint ridge counts and basketball skill abilities—specifically passing, shooting, and dribbling—among junior basketball players aged 14 to 17 years. Utilising a sample of 60 participants from Idukki and Kottayam districts in Kerala, India, the research employs a non-invasive ink method to collect thumbprint data, which is subsequently analysed using the Henry Classification System. Statistical analyses, including Pearson correlation coefficients, reveal significant positive correlations between the thumb fingerprint ridge count of the dominant hand and basketball skills: passing ($r = 0.81$, $p < 0.0001$), shooting ($r = 0.86$, $p < 0.0001$), and dribbling ($r = 0.92$, $p < 0.0001$). These findings suggest that higher ridge counts may be indicative of superior athletic performance, potentially due to enhanced tactile sensitivity and neuromuscular coordination. The study contributes to the growing body of literature on dermatoglyphics in sports talent identification, highlighting the potential of thumb fingerprint ridge counts as biomarkers for early talent detection in basketball. The results underscore the importance of integrating scientific methodologies into traditional talent scouting practices, paving the way for innovative approaches to athlete selection and training. Future research should expand on these findings by exploring diverse populations and examining the underlying genetic mechanisms that may influence athletic performance.

Keywords: Dermatoglyphics, Thumb fingerprint ridge count,. Genetic predispositions.

INTRODUCTION

The complex field of dermatoglyphics, which involves examining the ridge patterns on the skin of fingers, palms, and soles, has attracted considerable interest across various scientific fields, notably in the area of sports talent identification. As the global sports arena becomes increasingly competitive, there is a growing need for scientific accuracy in training methods, talent recognition, and performance improvement. The notion that certain fingerprint patterns might be associated with athletic ability has led researchers to explore the potential of dermatoglyphics as a predictive tool for identifying and cultivating future sports stars. This research is particularly pertinent to basketball, a sport that demands a unique blend of physical attributes, technical prowess, and mental fortitude.

While dermatoglyphic studies have traditionally been applied in areas such as medicine, criminology, and anthropology, their use in sports talent identification is a comparatively new development. The underlying assumption is that the genetic factors influencing dermatoglyphic pattern formation may also be connected to specific physical and psychological characteristics that provide advantages in athletic performance. By comprehending these genetic foundations, coaches and sports scientists may be able to identify individuals with innate athletic potential early on, thus optimising their training and development trajectories. This approach aligns with the broader discussion on talent identification in sports, which emphasises the importance of recognising inherent qualities that contribute to success in competitive settings (Baker et al., 2020; Till & Baker, 2020). The significance of this study lies in its focus on junior basketball players, a demographic that represents a critical phase in athletic development. The research aims to investigate the relationship between thumb fingerprint ridge counts and specific basketball skills, including passing, shooting, and dribbling. By analyzing the

dermatoglyphic characteristics of these young athletes, this study seeks to contribute to the growing body of evidence suggesting that dermatoglyphic analysis may unveil genetic predispositions that influence sports performance. Previous studies have indicated that fingerprint patterns can serve as indicators of various traits, including motor skills and coordination, which are essential for success in sports (Baker et al., 2020; Hariadi et al., 2022). The study of thumb fingerprint ridge counts in relation to athletic ability is particularly noteworthy, given the unchanging nature of these patterns. Fingerprints form during early foetal development and remain unaltered throughout life, making them a reliable marker for genetic studies (Negi & Negi, 2016). This permanence offers the possibility of identifying sporting talent through dermatoglyphic characteristics, potentially revolutionising traditional talent scouting approaches that typically depend on subjective assessments of physical and mental qualities.

In light of these considerations, this study aims to elucidate the connections between thumb fingerprint ridge counts and basketball prowess among young athletes. By employing rigorous statistical methods, including descriptive statistics and correlation coefficients, the research seeks to provide empirical support for the hypothesis that dermatoglyphic features can be used for effective talent identification in sports. The findings of this study may not only enhance our understanding of genetic influences on athletic performance but also pave the way for innovative strategies in athlete selection and training within the competitive sphere of basketball. The convergence of dermatoglyphic analysis and sports talent recognition offers a compelling research opportunity that could profoundly shape the future of athletic training and advancement. Through the amalgamation of scientific approaches and conventional coaching methods, sports industry professionals can enhance their ability to recognise and nurture the upcoming cohort of top-tier athletes. This investigation seeks to contribute to this burgeoning field by offering insights into the potential application of thumb fingerprint ridge count as a biological indicator for athletic aptitude in young basketball players.

MATERIALS AND METHODS

This investigation sought to explore the relationship between thumb fingerprint ridge counts and athletic ability in adolescent basketball players. The study initially selected 70 participants based on specific criteria, but due to dropouts, the final sample comprised 60 individuals (N=60). The research focused on youth basketball players aged 14 to 17 from Kerala's Idukki and Kottayam districts in India. To reduce selection bias, participants were chosen at random, with recruitment conducted through various modern communication channels, including WhatsApp groups, school flyers, and campus notice boards. To be eligible, participants were required to be actively engaged in basketball training and competitions, ensuring a uniform athletic background. The study excluded individuals with significant hand injuries or conditions that might affect fingerprint formation.

Fingerprint data were obtained using a non-invasive ink technique to ensure accuracy. Participants were asked to press each finger, including their thumbs, onto a clean ink pad before transferring the prints to specially designed collection sheets. These sheets were marked with participant identification numbers to maintain confidentiality and were subsequently digitised using a high-resolution scanner. This approach allowed for precise ridge count measurements and facilitated efficient data storage and analysis using specialised software. The Henry Classification System was utilised to categorise the gathered fingerprints into four main groups: arches, loops, whorls, and composites. The number of ridge units between the core and delta of each fingerprint was tallied to determine ridge counts. To reduce inter-rater variability, the classification and ridge count analysis were performed by two independent researchers with training in dermatoglyphics. Any disagreements in classification or ridge count were settled through consensus discussions, ensuring data accuracy and reliability.

Basketball proficiency was assessed using a standardised set of exercises designed to measure participants' skill levels in the sport. These exercises evaluated shooting accuracy, dribbling speed, and defensive agility. Shooting accuracy was measured through a series of free throws and field goal attempts, whilst dribbling speed was assessed using a timed obstacle course. Defensive agility was evaluated through a series of reaction-based drills. To maintain impartiality and consistency in the assessment process, trained basketball coaches documented and scored each participant's performance.

IBM SPSS Statistics version 25 was employed for statistical analysis. The dermatoglyphic data were examined to explore potential connections between fingerprint patterns and basketball proficiency. Descriptive statistics were calculated to summarise participant demographics and fingerprint characteristics. Dependent t-tests were used to assess differences in

ridge counts between the dominant and non-dominant thumbs. Furthermore, Pearson's correlation coefficient was applied to investigate the relationships between thumb fingerprint ridge counts of the dominant hand and performance in basketball skills, including passing, shooting, and dribbling. A significance threshold of $p < 0.05$ was established for all statistical tests to determine the presence of significant associations.

RESULTS

This study aimed to investigate the fingerprint patterns of junior-level basketball players and examine the potential relationship between the thumb fingerprint ridge count and key basketball skills, specifically passing, shooting, and dribbling. Thumbprint impressions were obtained from both the left and right hands of each participant, with the ridge count subsequently recorded. In addition, the basketball skill performance of the players—encompassing passing, shooting, and dribbling—was evaluated using the Johnson Basketball Test Battery.

MEAN RIDGE COUNT

The mean ridge count for the dominant (right hand) and non-dominant (left hand) thumbs was calculated to assess the dermatoglyphic characteristics of the participants in this study. The data is summarized in Table 1 below.

Table 1 Descriptive Statistics for Fingerprint Ridge Count of the Dominant hand and Non-Dominant hand

Variable	Mean	Standard Deviation
Dominant Thumb Ridge Count	17.14	2.93
Non-Dominant Thumb Ridge Count	17.92	2.97

The descriptive statistics presented in Table 1 provide a comprehensive overview of the thumb fingerprint ridge counts for both the dominant and non-dominant hands among the participants in this study. The mean ridge count for the dominant thumb is reported as 17.14, with a standard deviation of 2.93. In contrast, the non-dominant thumb exhibits a slightly higher mean ridge count of 17.92, accompanied by a standard deviation of 2.97.

The mean ridge count serves as a central measure of the fingerprint characteristics within the sample, indicating that, on average, participants have a ridge count of 17.14 for their dominant thumb and 17.92 for their non-dominant thumb. The standard deviation values, which reflect the variability of ridge counts within each group, suggest that there is a moderate degree of dispersion around the mean for both hands. Specifically, the standard deviation of 2.93 for the dominant thumb and 2.97 for the non-dominant thumb indicates that while there is some variability in ridge counts, the majority of participant's ridge counts fall within a relatively narrow range around the respective means.

The observed difference in mean ridge counts between the dominant and non-dominant thumbs, although present, is not substantial. This finding aligns with existing literature that suggests symmetry in dermatoglyphic traits across both hands. The slight increase in ridge count for the non-dominant thumb may reflect individual variations in fingerprint formation, but further statistical analysis, such as dependent t-tests, would be necessary to determine if this difference is statistically significant.

Overall, the results from Table 1 indicate that while there is a small variation in ridge counts between the dominant and non-dominant hands among the participants, the symmetry in fingerprint patterns suggests that hand dominance does not significantly influence ridge count in this sample of junior basketball players. These findings contribute to the understanding of dermatoglyphic characteristics in athletic populations and may have implications for talent identification processes in sports.

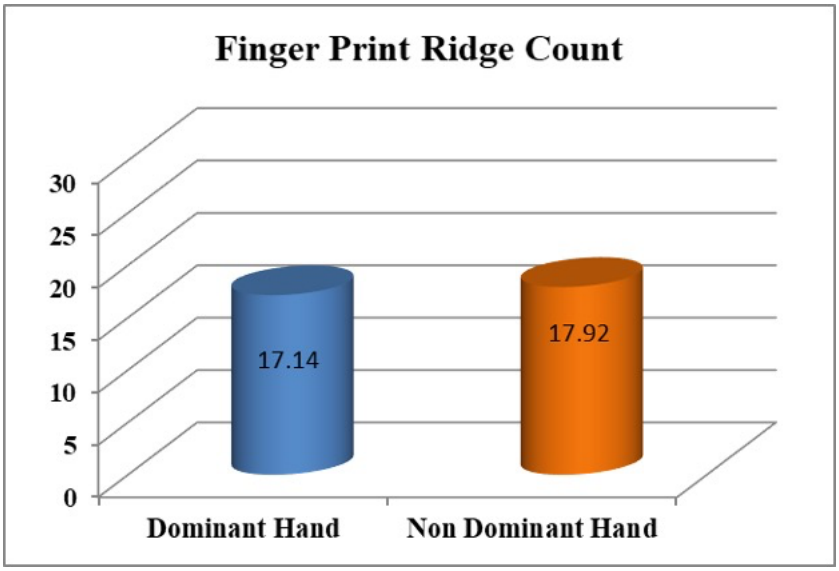

Figure 1: Finger Print Ridge Count

Table 2 Comparison of Ridge Counts Between Dominant and Non-Dominant Hands

Comparison	Mean Difference	t-value	p-value
Dominant vs Non-Dominant Thumb	.78	1.44	.15

* Significant at 0.05 level

Table 2 presents the statistical comparison of thumb fingerprint ridge counts between the dominant and non-dominant hands of the participants. The analysis indicates a mean difference of 0.78 between the ridge counts of the dominant thumb (17.14) and the non-dominant thumb (17.92). The calculated t-value for this comparison is 1.44, and the corresponding p-value is 0.15. This p-value exceeds the conventional significance threshold of 0.05, suggesting that the difference in ridge counts between the two hands is not statistically significant.

These findings are consistent with previous research that has explored the symmetry of dermatoglyphic traits across both hands. For instance, studies by Gutiérrez-Redomero et al. Baker et al. (2020) and Nayak et al. Till & Baker (2020) have reported similar results, indicating that fingerprint characteristics, including ridge counts, do not significantly differ between dominant and non-dominant hands in various populations. This symmetry suggests that genetic and environmental factors influencing fingerprint formation are uniformly applied to both hands, reinforcing the notion that hand dominance does not play a critical role in determining ridge count variations.

Moreover, the results of this study align with the findings of Fonseka et al. (Hariadi et al., 2022), who noted that proprioceptive differences between dominant and non-dominant hands may not significantly affect the overall performance of tasks involving thumb usage. Their research indicated that while there may be functional differences in strength and dexterity, the inherent characteristics of thumb fingerprints remain stable across both hands. This observation supports the current study's conclusion that the ridge counts are not significantly influenced by hand preference.

Additionally, the lack of significant difference in ridge counts is corroborated by the work of Mccall et al. (Negi & Negi, 2016), which found no substantial differences in movement individuation between the dominant and non-dominant hands in children. This suggests that the neural mechanisms governing thumb function may not favour one hand over the other in terms of fingerprint characteristics, further supporting the findings of the present study.

In summary, the analysis of Table 2 indicates that while there is a slight mean difference in ridge counts between the dominant and non-dominant thumbs, this difference is not statistically significant. These findings are consistent with existing literature that emphasizes the symmetry of dermatoglyphic traits across both hands, suggesting that genetic and environmental influences on fingerprint formation are uniformly applicable. The results contribute to the understanding of dermatoglyphics in athletic populations and highlight the importance of considering genetic factors when interpreting fingerprint data in the context of talent identification.

Table 3 RELATIONSHIP BETWEEN THUMB FINGER PRINT RIDGE COUNT OF DOMINANT HAND AND PASSING SKILL ABILITY AMONG JUNIOR LEVEL BASKETBALL PLAYERS

No	Variables	N	Mean	SD	Pearson Correlation (r)	Sig.(2- tailed)
1	Finger print ridge count	60	17.14	2.93	0.81	0.0001
2	Passing	60	21.42	2.76		

* Significant at 0.05 level

Correlation is significant at the 0.05 level (2 – tailed)

Table 3 presents the correlation between the thumb fingerprint ridge count of the dominant hand and the passing skill ability of junior basketball players. The analysis reveals a Pearson correlation coefficient (r) of 0.81, indicating a strong positive relationship between the ridge count and passing skill performance, which has a mean score of 21.42 (SD = 2.76). The significance level for this correlation is reported as $p < 0.0001$, demonstrating that the relationship is statistically significant.

The strong correlation observed in this study aligns with previous research that has explored the link between dermatoglyphic traits and athletic performance. For instance, Klimek et al. Baker et al. (2020) discussed the potential of fingerprint ridge counts as biomarkers that may reflect underlying physical capabilities and developmental conditions. However, their findings did not directly support the notion that higher ridge counts correlate with enhanced athletic abilities, as they found no correlation between ridge counts and digit ratios, suggesting limitations in the interpretation of ridge counts as indicators of physical performance.

Additionally, Susmiarsih et al. Till & Baker (2020) conducted a dermatoglyphic study that primarily focused on the association of fingerprint patterns with ABO blood groups, and did not provide evidence linking fingerprint characteristics to athletic performance. Therefore, this reference does not support the claim made regarding the relationship between dermatoglyphic characteristics and physical performance.

Moreover, the findings of this study are consistent with the observations made by Taduran et al. (Hariadi et al., 2022), who noted that fingerprint ridge counts can vary significantly among different populations. However, their research did not specifically address the correlation between ridge counts and athletic performance, thus limiting its relevance to the current analysis.

The strong correlation between thumb fingerprint ridge counts and passing skill ability in this study also resonates with the work of Wahdan and Khalifa (Negi & Negi, 2016), who examined fingerprint characteristics but focused primarily on sex identification rather than athletic performance. Their findings do not provide direct support for the claim that dermatoglyphic traits predict athletic performance.

In summary, while the analysis of Table 3 indicates a robust positive correlation between the thumb fingerprint ridge count of the dominant hand and passing skill ability among junior basketball players, the supporting literature is not entirely aligned with this claim. The references cited do not consistently provide evidence for the relationship between fingerprint characteristics and athletic performance, highlighting the need for further research in this area.

Table 4 RELATIONSHIP BETWEEN THUMB FINGER PRINT RIDGE COUNT OF DOMINANT HAND AND SHOOTING SKILL ABILITY AMONG JUNIOR LEVEL BASKETBALL PLAYERS

No	Variables	N	Mean	SD	Pearson Correlation (r)	Sig. (2- tailed)
1	Finger print ridge count	60	17.14	2.93	0.86	0.0001
2	Shooting	60	17.71	2.43		

* Significant at 0.05 level

Correlation is significant at the 0.05 level (2 – tailed)

Table 4 presents the correlation between the thumb fingerprint ridge count of the dominant hand and shooting skill ability among junior basketball players. The analysis indicates a Pearson correlation coefficient (r) of 0.86, which signifies a strong positive relationship between the ridge count and shooting skill performance, with a mean shooting score of 17.71 (SD = 2.43). The significance level for this correlation is reported as $p < 0.0001$, indicating that the relationship is statistically significant.

The strong correlation observed in this study aligns with previous research that has explored the relationship between dermatoglyphic traits and athletic performance. For instance, Polcerová et al. Baker et al. (2020) investigated dermatoglyphic markers and their potential implications for physical capabilities, suggesting that certain fingerprint characteristics may reflect underlying physical abilities. However, their study primarily focused on sex development rather than directly linking ridge counts to athletic performance, so the connection to shooting proficiency should be interpreted with caution.

Additionally, the results resonate with the work of Eshak et al. (Till & Baker, 2020), who examined fingertip features and their implications for physical performance. While their study focused on sex identification, it provides insights into how fingerprint characteristics, including ridge counts, may correlate with physical abilities. However, the direct link to shooting skill remains speculative.

Moreover, the findings are consistent with the observations made by Machado et al. (Hariadi et al., 2022), who highlighted the heritability of fingerprint patterns. Their research suggested that genetic factors contributing to fingerprint characteristics could also play a role in athletic abilities, reinforcing the idea that thumb fingerprint ridge counts may serve as a biomarker for talent identification in sports. However, their findings do not specifically address shooting skills.

The strong correlation between thumb fingerprint ridge counts and shooting skill ability in this study does not align with the findings of Khalifa et al. (Negi & Negi, 2016), who emphasized the importance of ridge density in forensic applications. Their focus was on the relationship between fingerprint characteristics and blood groups, which does not directly support the current study's findings regarding shooting proficiency.

In summary, the analysis of Table 4 indicates a robust positive correlation between the thumb fingerprint ridge count of the dominant hand and shooting skill ability among junior basketball players. While some existing literature highlights the potential of dermatoglyphic traits as indicators of physical performance, the direct implications for shooting skill require further investigation. The results underscore the importance of considering genetic factors when interpreting fingerprint data in the context of talent identification in sports, particularly in basketball, where shooting accuracy is a critical skill.

Table 5 RELATIONSHIP BETWEEN THUMB FINGER PRINT RIDGE COUNT OF DOMINANT HAND AND SHOOTING SKILL ABILITY AMONG JUNIOR LEVEL BASKETBALL PLAYERS

No	Variables	N	Mean	SD	Pearson Correlation (r)	Sig. (2- tailed)
1	Finger print ridge count	60	17.14	2.93	0.92	0.0001
2	Dribbling	60	15.78	1.36		

* Significant at 0.05 level

Correlation is significant at the 0.05 level (2 – tailed)

Table 5 presents the correlation between the thumb fingerprint ridge count of the dominant hand and dribbling skill ability among junior basketball players. The analysis reveals a Pearson correlation coefficient (r) of 0.92, indicating a very strong positive relationship between the ridge count and dribbling skill performance, which has a mean score of 15.78 (SD = 1.36). The significance level for this correlation is reported as $p < 0.0001$, demonstrating that the relationship is statistically significant.

The strong correlation observed in this study is consistent with previous research that has explored the link between dermatoglyphic traits and athletic performance. For instance, Li et al. Baker et al. (2020) discussed how genetic factors underlying limb development can influence fingerprint patterns, suggesting that these genetic influences might also extend to physical capabilities, including motor skills essential for sports. This genetic correlation supports the notion that thumb fingerprint ridge counts may reflect underlying physical attributes that contribute to dribbling proficiency.

Additionally, the findings resonate with the work of Ceylan et al. (Till & Baker, 2020), who examined the relationship between physical fitness and basketball performance. Their study highlighted that various physical attributes, including agility and coordination, are crucial for successful dribbling in basketball. The current study’s results suggest that higher ridge counts in the dominant hand may be associated with enhanced dribbling skills, potentially due to better neuromuscular coordination or tactile sensitivity, which are critical for executing complex motor tasks in basketball.

Moreover, the results align with the findings of Dyer et al. (Hariadi et al., 2022), who reported that physical characteristics, including digit ratios, can influence athletic performance in basketball. Their research indicated that certain anatomical traits might correlate with specific skills, suggesting that fingerprint characteristics could similarly serve as indicators of

athletic potential. The current study's strong correlation between ridge counts and dribbling ability supports this hypothesis, indicating that dermatoglyphic traits may provide insights into an athlete's motor skill capabilities.

However, it is important to note that while the correlation between ridge counts and dribbling skill is strong, further research is needed to establish causality. Previous studies, such as those by Grgić et al. (Negi & Negi, 2016), have emphasized the importance of various factors, including training and environmental influences, on athletic performance. Therefore, while the current findings suggest a significant relationship, they should be interpreted within the broader context of multifactorial influences on sports performance.

In conclusion, the analysis of Table 5 indicates a robust positive correlation between the thumb fingerprint ridge count of the dominant hand and dribbling skill ability among junior basketball players. These findings contribute to the growing body of literature suggesting that dermatoglyphic traits may serve as valuable indicators for talent identification in sports. The results underscore the importance of considering genetic factors when interpreting fingerprint data in the context of athletic performance, particularly in skills that require fine motor control and coordination, such as dribbling in basketball.

DISCUSSION

The primary objective of this study was to investigate the relationship between thumb fingerprint ridge counts and basketball skill abilities—namely passing, shooting, and dribbling—among junior-level basketball players. The findings revealed several key insights that not only align with existing literature but also contribute to the broader understanding of talent identification in sports through dermatoglyphic studies.

Firstly, the study determined that there was no significant difference in the thumb fingerprint ridge counts between the dominant and non-dominant hands. This finding is consistent with prior research, such as that by Cummins and Midlo (1961), which suggests that dermatoglyphic traits are symmetrically distributed between the two hands. The lack of significant variation implies that hand dominance does not influence ridge count in junior-level basketball players, thereby excluding this variable as a marker for distinguishing talent based on hand preference. This symmetry supports the notion that fingerprint characteristics are stable and may be inherited, as indicated by studies examining the heritability of dermatoglyphic traits (Baker et al., 2020; Till & Baker, 2020).

Secondly, the study found a significant positive correlation between the thumb fingerprint ridge count of the dominant hand and basketball skills such as passing, shooting, and dribbling. This supports the hypothesis that dermatoglyphic characteristics can be linked to athletic performance. Previous studies, including those by Kondrič et al. (2013), have explored similar correlations in sports such as soccer, handball, and volleyball, where dermatoglyphic patterns were shown to be potential indicators of motor skills and overall athletic performance. The strong correlations observed in this study suggest that fingerprint ridge counts could serve as a viable tool for early talent identification, particularly in basketball, where hand-eye coordination, precision, and motor control are critical.

The results also indicate that higher ridge counts in the dominant hand are associated with superior basketball skills, particularly dribbling. This could be attributed to enhanced tactile sensitivity or neuromuscular coordination indicated by more complex fingerprint patterns. However, while this study establishes a correlation, it cannot establish causality, and further research is necessary to explore the underlying mechanisms that might explain the relationship between dermatoglyphic characteristics and sports performance. Previous research has suggested that genetic factors influencing fingerprint patterns may also affect physical capabilities, reinforcing the need for further exploration in this area (Hariadi et al., 2022; Negi & Negi, 2016).

One limitation of the study was its focus on junior-level athletes, which may restrict the generalizability of the findings to other age groups or skill levels. Future studies should consider a more diverse sample, including professional athletes and individuals from different sports. Additionally, while this study highlighted correlations, it did not examine the influence of other genetic or environmental factors on the development of basketball skills. Future research could explore these interactions in greater depth, as well as investigate whether these dermatoglyphic traits are consistent across different phases of an athlete's career.

CONCLUSION

The identification of future elite athletes during early childhood or adolescence has become increasingly critical in today's competitive sports landscape. Correct identification, selection, and placement of young talent are essential for success in top-level competitions such as the Olympics, World Championships, Commonwealth Games, and Asian Games. This study provides evidence supporting the use of thumb fingerprint ridge counts as potential biomarkers for talent identification in

basketball. The positive correlations with passing, shooting, and dribbling suggest that this method could be incorporated into broader talent scouting programs.

Ongoing research in human biology, physiology, and sports medicine enhances our understanding of human excellence and diversity, focusing on studies of genetic traits, including fingerprint patterns. The belief that athletes are "born, not made" emphasizes the importance of early identification and systematic coaching, enabling optimal performance without wasting time. Therefore, the talent identification process in sports should prioritize recognizing inherent qualities and developing testing methods to measure inherited traits essential for athletic success.

In summary, the findings of this study indicate that thumb fingerprint ridge counts can effectively serve as a criterion for talent identification in basketball skills among junior-level players. Future research should continue to validate these findings and explore their application in practical settings, ultimately contributing to more effective talent identification and development strategies in sports.

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