

Specific physical development of midfielders in comparative football from youth to senior level: Insight from objective parameters measured with advanced wearable technology.

IZZO R¹, CATANI A², CEJUDO A³, CRUCIANI A⁴, GIOVANNELLI M.⁵, HOSSEINI C.⁶, CRUDELINI E.⁷

^{1,2,5,6,7} Department of Biomolecular Sciences, School of Sport Science, Exercise and Health, University of Urbino Carlo Bo, Urbino, Pesaro e Urbino 61029, ITALY.

^{1,3} Musculoskeletal System and Sport Research Group. Department of Physical Activity and Sport. Faculty of Sports Sciences. Mare Nostrum Campus of Excellence. University of Murcia SPAIN

⁴ Research and Development Department, K-Sport Universal, ITALY.

Performed by **ARGS**, Advanced Research Group in Sport, School of Health and Sport Science with K-Sport Universal, ITALY.

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Abstract

Although relatively unrepresented in scientific literature, this study aims to establish foundational insights into the developmental trajectory of midfield football players as they transition from youth to senior levels. The research primarily examines physical and athletic attributes while also considering their interaction with specific technical and tactical aspect. The study focuses on players aged 14-23 years. The limited existing research on this topic has, hindered comparative analysis but also created an opportunity to explore an underexamined area. This investigation uses wearable scientific instrumentation (K-AI, K-Sport Ita) to provide new insights into player development. The parameters under scrutiny encompass a spectrum of physical attributes, including distance covered, speed dynamics, acceleration, and deceleration patterns. Of particular interest is the evaluation of High Peak Speed (HPS), denoting the pinnacle of instantaneous velocity within defined temporal intervals. Furthermore, the discerning factor in an athlete's developmental journey lies not solely in their maximal speed potential, but rather in their capacity to sustain high-intensity sprints and consistently surpass the HPS threshold during match scenarios (Izzo et al., 2018). This nuanced perspective emerges as a pivotal and discerning criterion for assessing the prowess of football athletes.

Keywords; Attributes midfield speed deceleration dynamics interaction acceleration evaluations

Introduction

Currently, there is a dearth of scientific literature specifically addressing the subject matter at hand. This study endeavors to delineate the elements characterizing the physical performance growth of midfielders in soccer, leveraging advanced technologies, from youth to senior competitive levels, covering an age range of 14 to 23 years. The limited scope of literature on this topic precludes useful comparative analysis, rendering our data a preliminary reference point for discussion. Substantial elements considered pivotal in the athletes' developmental trajectory in this role include distances covered, speed dynamics, positive and negative acceleration (deceleration), and their specific manifestations.

Of particular interest is the evaluation of High Peak Speed (HPS), representing the apex of instantaneous velocity recorded within a given timeframe. Here, instantaneous velocity is defined as the limit of average velocity over very brief time intervals, i.e., the derivative of position with respect to time.

In a previous study, the trend of High Peak Speed (HPS) was observed (in a sample of 120 footballers), illustrating speed growth across various developmental stages. This analysis yields insights into assigning distinct growth rates across ages, which are not necessarily proportional. For example, an 8% growth was observed between U-12 and U-14, a 10% growth between U-14 and U-16, and a 3% growth between U-16 and U-18, culminating in an overall growth rate of 21% within the Academy age range (12-18 years). As for the number of higher HPS events, it exponentially increases from U-16 to U-18, with a 72% difference, compared to 0% between U-14 and U-16 and 40% from U-12 to U-14. Therefore, what will differentiate an amateur athlete from a professional one will not be the maximum speed value achievable, but rather the ability to produce a high distance value in sprints and to exceed the HPS threshold multiple times during matches (Izzo et al., 2018).

In modern football, controlling and regulating physical fitness is deemed a crucial methodological procedure to optimize training adaptations and enhance match outcomes. Increased fitness predominantly results from the interaction between external and internal loads imposed on players during training sessions. Notably, the utilization of precise technologies (GPS, IMU, and special cameras) in recent years has revolutionized training parameters at high and elite levels. This transformation is likely to cascade as a necessity across all

categories, especially within youth sectors, where inaccuracies in quantifying proposed workload can significantly impede both player development and health.

The deployment of these aforementioned tools undeniably introduces new avenues to tailor training sessions and demands to the actual needs of different teams, enhancing performance, and delineating a novel approach with scientific calibration of external load relative to athletes' individual qualities and objectives. This paradigm shift challenges the traditional one-size-fits-all training approach, which often fails to address the unique and diverse needs of players as individuals.

Football is considered an intermittent aerobic/anaerobic sport, involving maximal sprints, directional changes, elevations, and duels, interspersed with varying lengths of recovery periods. Analyzing players' performances during matches and training sessions has been a primary focus of sports sciences for the past decade and beyond, albeit with methods not always reliable, aiming to scientifically establish the most appropriate individual performance model for players in this sport (Player Performance Model-PPM). Based on playing styles and the characteristics of players involved in matches, Mohr and other researchers (Mohr et al., 2003), in agreement with other studies, assert that players predominantly walk on the field at low speeds for most of the time, covering about 10 km per match with an energy expenditure of 61 kJ/kg, of which 42% is attributed to high-intensity actions. During matches, players execute sprints every 90 seconds, each lasting an average of 2-4 seconds, covering 0.5/3% of the total game time. They are typically shorter than 30 m in 96% of cases and shorter than 10 m in 50% of cases. Accelerations and decelerations are another crucial aspect; accelerations are calculated from 2.5 to 4 m/s², while decelerations range from -2.5 to -4 m/s², with players averaging 100 speed variations per match. Another critical ability in football is the capacity to repeat sprints during matches, which can be enhanced through specific training regimens (Raiola et al., 2014, Vitale et al., 2018.) Football is characterized by approximately 1200 non-cyclical and unpredictable movements, including 30-40 sprints, over 700 rotations, and 30-40 tackles and jumps (Altavilla, 2019, D'Isanto et al., Iaia et al., 2009). This team sport entails periods of high-intensity activity interspersed with lower-intensity actions, as well as technical and tactical components (Sparkes et al., 2018). Recent studies have shown that football players cover between 8000 and 14000 m during a match (Aguiar et al., 2012), demonstrating that various physical abilities such as running, kicking, dribbling, and tackling can influence players' performances (D'Elia et al., 2019). These exertions increase players' specific physical demands and contribute to characterizing football as a sport with high and diverse metabolic and physiological requirements (Iaia et al., 2009; Arslan et al., 2017). Furthermore, computerized motion analyses and videos have revealed that high-level football players cover 2-3 km at high intensity (>15 km/h) and approximately 0.6 km in sprints (>20 km/h) per match. From the limited evidence available in specific literature, primarily of a general nature regarding the midfielder's role, a substantial and sensitive difference in physical characteristics, as well as technical-tactical aspects, between midfielders and other positions can be discerned. This forms the fundamental rationale for selecting this role for examination, thereby profiling a characterization of the role even in a bioenergetic context. The results confirm some long-known points, such as central defenders experiencing relatively lower demands in terms of high-intensity movements compared to other roles. Conversely, wingers (both defenders and midfielders, as well as attackers) exhibit higher physical demands. In the specific case of midfielders, those deployed centrally execute numerous backward runs to balance the team when possession is lost. This locomotion pattern is likely, albeit not conclusively proven, to be most affected by fatigue.

The other two locomotor/tactical modes of the midfielder are:

- Runs supporting play during positive transitions;
- Movements made to cover spaces opposing opponents.

Midfielders are particularly involved in transition actions, and when not in possession, they are required to execute retreat runs in emergency situations towards their own goal, characteristics for which it is evident that strength, overall, and specific endurance must be integral components of the role's energy profile.

Regarding the midfielder's physical profile, it must inherently encompass both the capacity to sustain intense intermittent exercise and general aerobic capacities, in addition to specific strength and endurance.

Aim The primary objective was to monitor three midfielders from each distinct age group throughout training sessions and matches, thereby tracing their developmental trajectory through the amassed data, which encapsulated both physical and partially technical aspects, with the intention of formulating parameters conducive to characterizing athletes across varying chronological stages.

Methods and Materials

Participants

The cohort comprised 18 athletes affiliated with A.S.D. Urbania Calcio, situated in the Marche region, Italy. Acknowledged by the FGCI as an Elite soccer academy, the club boasts a first-team presence in the Eccellenza championship.

Data collection commenced on March 6 and concluded on May 1, encompassing approximately two training sessions and one match per team per week, with adaptations made due to the limited availability of just three instruments. In accordance with ethical protocols, all underage participants received a document for parental consent, outlining the research parameters, proposed testing procedures, and research team composition.

Additionally, an introductory briefing was conducted to elucidate the functionality of the instruments (KAI, k-fitness software, K-Sport, Ita.), emphasizing their non-intrusive nature and operational protocols. For adult participants, direct consent was solicited.

Athletes were categorized as follows:

- 6 players from the Giovanissimi category (Teams 1 and 2): born in 2007, 2008, 2009
- 6 players from the Allievi category (Teams 1 and 2): born in 2005, 2006
- 3 players from the Juniores category: born in 2003, 2004
- 3 players from the first-team Eccellenza category (TOP): born in 1998, 1999, 2001

Consequently, six championships were monitored, with comparisons drawn between:

- Prima Squadra and Juniores (J)
- Allievi A and Allievi B (AA and AB)
- Giovanissimi A and Giovanissimi B (GA and GB)

It is noteworthy that matches involving Giovanissimi A and B comprise two halves of 35 minutes, as opposed to the standard 45-minute duration across all other categories. We posit that establishing comparative param across different age groups can significantly enhance the delineation of project objectives, transcending reliance solely on staff experience and subjective assessments.

Below is a tabulated summary of the athletes participating in the study.

Table 1. General Data of the Athletes

ATHLETE	Year	Team	Sex	Weight (kg)	Height (cm)
Athlete 1	30.08.1998	1 st Team	M	66	174
A2	08.07.1999	1 st Team	M	73	179
A3	20.03.2001	1 st Team	M	74	181
A4	24.07.2003	J	M	65	173
A5	02.08.2003	J	M	81	179
A6	03.10.2003	J	M	70	173
A7	27.01.2005	AA	M	64	175
A8	30.07.2005	AA	M	60	171
A9	19.12.2005	AA	M	65	172
A10	17.05.2006	AB	M	75	172
A11	02.08.2006	AB	M	80	187
A12	04.10.2006	AB	M	64	178
A13	26.01.2007	GA	M	60	180
A14	28.08.2007	GA	M	70	174
A15	15.11.2007	GA	F	54	160
A16	14.01.2008	GB	M	63	180
A17	27.07.2008	GB	M	62	175
A18	09.06.2009	GB	M	61	156

Instrumentation

For this study, instrumentation considered state-of-the-art in the current market (utilized by the Serie A Football League in Italy) was employed, specifically:

- **K-AI (50 Hz):** Used by over 50% of Elite teams in Italy, Europe, and some worldwide. It is the world's smallest professional device with the highest sampling frequency (50 Hz). It employs a revolutionary Sensor Fusion (SF) technology that combines, through firmware with high computational capabilities, tracking detectors with the inertial sensors contained within the same instrument. Of significant importance is that the satellite tracking detector utilizes not only GPS but four constellations, namely GPS, Kompass, Beidou, and Glonass, effectively quadrupling the satellites with which the instrument communicates, thus providing extremely high signal coverage and density.

- **Dynamix Platform:** Since 2015, the official platform of the Italian Serie A Football League, equipped with K-fitness software for overall data analysis. This platform offers the ability to analyze over 300 param, with the option to create customized formulas and methods. It utilizes individual thresholds relative to maximum values, enabling effective comparison of individual performance levels. Additionally, it integrates physical and technical-tactical data and automatically detects the most intense moments of the game in real-time.

Smart Vest: These are fabric-informed shirts (smart textiles), with a rear pocket featuring internal attachments for KAI connection.

A standard composition computer.

The param studied in this work are as follows:

T (time): Corresponds to the total time of a single exercise, single period, entire training session, or entire match.

D (distance traveled): Corresponds to the space covered by an athlete during a single exercise, single period, entire training session, or entire match.

D_SHI: Corresponds to the distance covered by an athlete at high intensity, specifically above 16 km/h.

- D_S5:** Corresponds to the distance covered by an athlete at very high intensity, specifically above 20 km/h.
- D_S6:** Corresponds to the distance covered by an athlete at extremely high intensity, specifically above 24 km/h.
- NU_S6:** Corresponds to the number of sprints performed above 24 km/h.
- D_A1:** Corresponds to the distance covered by an athlete during deceleration less than -3 m/s².
- D_A8:** Corresponds to the distance covered by an athlete during acceleration greater than 3 m/s².
- ND_A1:** Corresponds to the total number of decelerations less than -3 m/s².
- NU_A8:** Corresponds to the total number of accelerations greater than 3 m/s².
- T_A1:** Corresponds to the time spent in deceleration less than -3 m/s².
- T_A8:** Corresponds to the time spent in acceleration greater than 3 m/s².
- Smax:** Corresponds to the maximum velocity reached, in km/h. The number provided by the platform must be multiplied by 3.6 to obtain the maximum velocity in km/h.

Procedure

After consulting with the coaches of the respective categories under analysis and informing them of the work protocol, three midfielders were selected based on their seriousness, physical, technical, and tactical qualities. The requirement for both coaches and players was their maximum participation in matches and training sessions, allowing for a sufficient number of events to conduct a scientifically meaningful analysis, albeit a pilot study on the evolution of midfielders such as this. Data was collected for two consecutive months, both for training sessions and matches, recording the data of two/three teams each day (afternoon training sessions). To facilitate data collection, coaches and players were familiar with the operation of the instruments. A daily diary was created to record all time indications, teams, and individuals for each training session and match, including the general start and end times, as well as the start and end times of each individual exercise, rather than individual periods during matches. The accuracy of the above-mentioned data recordings proved necessary for subsequent temporal and intensity selections ("cuts") on individual exercises to be inserted into the Dynamix platform (K-Sport, Ita). The selection of items of interest on the platform, which offers over 300 selection possibilities in total, allowed for the optimal delineation of research elements. After selecting the items of interest and loading all the data from the recordings, an electronic spreadsheet was created to exemplify their interpretation. At the end of each data collection day, the instruments were downloaded and formatted for subsequent use. Additionally, all instruments were recharged, and Smart Vests were sanitized.

Data Analysis

Comparison between Giovanissimi G 2007 and Giovanissimi G 2008

The first comparison made was between the two age groups of the Giovanissimi category, the youngest in competitive football. Unlike Allievi, Juniores, and the Prima Squadra, these athletes play two halves of 35 minutes each, totaling 70 minutes per match, as opposed to the other categories, which play two halves of 45 minutes each, totaling 90 minutes. During matches, the comparison is realistic because the timings are the same. Regarding training sessions, however, it is not easy to compare athletes since even in the same exercise (such as a 7 vs. 7 match), the timings differ due to varying situations, coaches, and consequently, imposed breaks. Therefore, concerning training sessions, distance data proved less useful for the purpose of this research, unlike more accurate comparisons for all other data such as accelerations, decelerations, and maximum speed attained. It should be noted that in the comparison between different teams, there are issues related to the different coaching methods in terms of exercise duration and recoveries. However, we believe this did not affect the objectives of our work.

Below are the graphs of the 4 param under comparison:

%D_SHI: Percentage of distance covered at high intensity above 16 km/h.

%D_A1: Percentage of m covered in deceleration <-3 m/s².

%D_A8: Percentage of m covered in acceleration >3m/s².

Smax: Maximum speed reached.

“Team Average 1” corresponds to the Giovanissimi 2007, whereas **“Team Average 2”** corresponds to the Giovanissimi 2008.

Match on March 20th



Graph 1. Comparison of the First Half on March 20th between Giovanissimi 2007 and Giovanissimi 2008 (LEFT)

Graph 2. Comparison of the Second Half on March 20th between Giovanissimi 2007 and Giovanissimi 2008 (RIGHT)

Subsequently, the tables of the same matches with all the data analyzed for this study will be provided.

Table 2. Match Analysis for Giovanissimi 2007 on March 20th (LEFT)

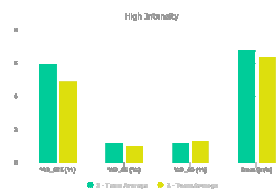
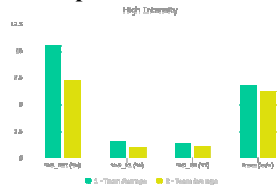
FIRST HALF													
	D	D_SH	D_SS	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56
Team Average	3413	120	8	57	60	20	0:37:51	16	0:00:27	0:00:26	6.1	0	0
Athlete 14	3310	167	12	65	72	23	0:37:51	20	0:00:28	0:00:28	6.3	0	0
Athlete 15	3515	73	4	49	48	17	0:37:51	11	0:00:27	0:00:24	5.8	0	0
SECOND HALF													
	D	D_SH	D_SS	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56
Team Average	3048	120	56	39	51	8	0:35:00	14	0:00:19	0:00:22	7.1	16	2
Athlete 14	2968	147	73	51	70	11	0:35:00	21	0:00:23	0:00:28	7.8	33	3
Athlete 15	3128	192	43	28	32	6	0:35:00	7	0:00:15	0:00:15	6.4	0	0

Table 3. Match Analysis for Giovanissimi 2008 on March 20th (RIGHT)

FIRST HALF													
	D	D_SH	D_SS	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56
Team Average	3290	180	32	31	35	7	0:36:03	4	0:00:15	0:00:15	5.9	0	0
Athlete 17	3921	247	63	42	46	8	0:36:03	6	0:00:20	0:00:20	6.1	0	0
Athlete 18	2659	113	1	20	24	5	0:36:03	1	0:00:10	0:00:10	5.6	0	0
SECOND HALF													
	D	D_SH	D_SS	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56
Team Average	3227	144	39	50	42	11	0:37:45	7	0:00:24	0:00:18	6.3	7	1
Athlete 17	3539	176	38	58	46	15	0:37:45	8	0:00:27	0:00:19	7.2	10	1
Athlete 18	804	16	0	8	11	0	0:12:53	1	0:00:05	0:00:05	5.4	0	0

In this match, we observe two halves with varying data, particularly regarding the distance covered. Indeed, the Giovanissimi 2007 commence the first half at a sustained pace, experiencing a decrease of 400 m in total distance during the second half, whereas the Giovanissimi 2008 maintain more or less the same distance between the first and second halves. The distance covered at high intensity, exceeding 16 km/h, significantly increases during the second half for the Giovanissimi 2007 and decreases in that of the Giovanissimi 2008. The number of accelerations above 3 m/s² is higher in the first half for the Giovanissimi 2007 and then higher in the second half for the Giovanissimi 2008. Conversely, decelerations below -3 m/s² are consistently higher in the Giovanissimi 2007. Furthermore, both categories surpass 24 km/h only in the second half. The maximum speed in this match is achieved by Athlete 14 (Giovanissimi 2007) in the second half, reaching 28.08 km/h.

Match on April 3rd and 4th



Graph 3. Comparison of the first half on April 4th for Giovanissimi 2007 and April 3rd for Giovanissimi 2008 (LEFT)

Graph 4. Comparison of the second half on April 4th for Giovanissimi 2007 and April 3rd for Giovanissimi 2008 (RIGHT)

Table 4. Match on April 4th for Giovanissimi 2007

FIRST HALF													
	D	D_SH	D_SS	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56
Team Average	2677	385	110	59	50	21	0:38:19	13	0:00:26	0:00:21	6.8	4	1
Athlete 14	3525	334	54	66	74	24	0:38:19	21	0:00:27	0:00:29	6.8	4	1
Athlete 15	3770	338	125	52	42	15	0:38:19	8	0:00:24	0:00:18	6.8	9	1
Athlete 13	3736	482	151	59	35	24	0:38:19	9	0:00:26	0:00:16	6.7	1	0
SECOND HALF													
	D	D_SH	D_SS	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56
Team Average	2997	164	41	36	37	9	0:40:20	8	0:00:16	0:00:16	6.8	1	0
Athlete 14	3031	197	42	54	57	11	0:40:20	12	0:00:24	0:00:22	7	4	1
Athlete 15	3730	109	30	31	36	9	0:40:20	7	0:00:16	0:00:17	6.6	0	0
Athlete 13	2230	186	50	21	19	7	0:40:20	6	0:00:08	0:00:08	6.6	0	0

Table 5. Match on April 3rd for Giovanissimi 2008

FIRST HALF													
	D	D_SH	D_SS	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56
Team Average	2904	212	24	33	36	9	0:38:09	8	0:00:16	0:00:17	6.3	0	0
Athlete 18	2904	212	24	33	36	9	0:38:09	8	0:00:16	0:00:17	6.3	0	0
SECOND HALF													
	D	D_SH	D_SS	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56
Team Average	3026	159	30	33	41	6	0:39:01	6	0:00:16	0:00:17	6.4	5	1
Athlete 17	3547	247	56	48	58	9	0:39:01	8	0:00:24	0:00:23	7	10	1
Athlete 18	2504	71	3	19	23	3	0:39:01	3	0:00:09	0:00:11	5.7	0	0

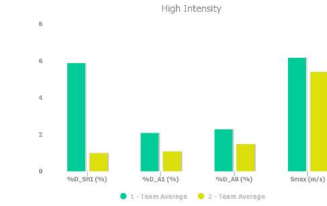
In this match analysis, a notable disparity emerges in the distance covered during the initial half among the Giovanissimi 2008 cohort, albeit this data point may be somewhat skewed as only one of the three selected athletes is actively participating. Subsequently, the subsequent half displays a convergence in distance metrics between the two age cohorts. Notably, there is a discernible reduction in high-intensity distance traversed above the 16 km/h threshold for both groups in the latter half, suggestive of a potential physiological decrement in performance attributed to fatigue during the latter stages of play. Further analysis reveals that the count of accelerations surpassing 3 m/s² is notably elevated in the first half for the Giovanissimi 2007 cohort and remains consistent across both halves for the Giovanissimi 2008 cohort. Conversely, instances of decelerations below -3 m/s² exhibit a decline in frequency during the latter half for the Giovanissimi 2007 and an increase for their Giovanissimi 2008 counterparts. Additionally, the Giovanissimi 2007 athletes achieve speeds exceeding 24 km/h on multiple occasions during the initial half, whereas their Giovanissimi 2008 counterparts achieve such speeds exclusively in the latter half. The pinnacle of velocity in this match is attained by Athlete 14 (Giovanissimi 2007) and Athlete 17 (Giovanissimi 2008) during the latter half, registering at 25.20 km/h.

Match on April 24th and May 1st

In this match a juxtaposition arises between the Giovanissimi 2007 and Giovanissimi 2008 cohorts, notably evident in their distance coverage throughout both halves. Specifically, the Giovanissimi 2007 cohort demonstrates a propensity for greater distance traversed across both halves compared to their Giovanissimi 2008 counterparts. Additionally, the extent of high-intensity distance exceeding the 16 km/h threshold exhibits augmentation during the latter half for both cohorts, with the Giovanissimi 2007 cohort consistently surpassing

their counterparts in this regard. The consistency of accelerative efforts exceeding 3 m/s² remains unaltered between halves for the Giovanissimi 2007 cohort, markedly higher than their Giovanissimi 2008 counterparts, who display a decline in the latter half. A parallel trend is observed in deceleration instances below -3 m/s². Furthermore, instances of surpassing the 24 km/h threshold are demonstrated by the Giovanissimi 2007 cohort in both halves, particularly accentuated in the latter half, whereas the Giovanissimi 2008 cohort fails to attain such speeds throughout. The pinnacle of velocity achievement in this match is credited to Athlete 14 (Giovanissimi 2007) during the latter half, recording at 29.16 km/h.

Training Session on March 18



Graph 5. Comparison of Training on March 18: Giovanissimi 2007 vs. Giovanissimi 2008

Table 6. Training on March 18: Giovanissimi 2008

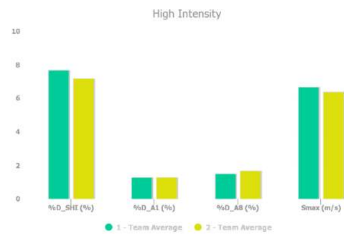
COACH'S WARM-UP													
D	D_SHT	D_SS	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56	
Team Average	1971	35	23	10	12	2	0:12:23	0	0:00:06	0:00:05	5,7	0	0
Athlete 14	1388	87	46	12	11	2	0:12:23	1	0:00:08	0:00:04	6,6	0	0
Athlete 15	1354	23	0	7	13	1	0:12:23	0	0:00:04	0:00:06	4,8	0	0

Table 7. Training on March 18: Giovanissimi 2007

COACH'S WARM-UP													
D	D_SHT	D_SS	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56	
Team Average	2155	37	3	7	8	2	0:07:07	0	0:00:04	0:00:03	5,6	0	0
Athlete 14	535	39	3	9	10	1	0:07:07	0	0:00:06	0:00:05	5,7	0	0
Athlete 15	503	11	0	6	10	2	0:07:07	0	0:00:04	0:00:04	5,1	0	0
Athlete 13	509	21	6	4	5	0	0:07:07	0	0:00:02	0:00:02	5,9	0	0

As previously noted, comparing two training sessions is inherently challenging, regardless of the age groups involved, due to differences in session structure, timing, and coaching methods. The Giovanissimi 2007 team trained for 1 hour and 21 minutes, covering a total distance of 6.336 km. In contrast, the Giovanissimi 2008 team trained for 1 hour and 24 minutes, covering a total distance of 5.095 km. The Giovanissimi 2007 covered 372 m at speeds exceeding 16 km/h, while the Giovanissimi 2008 covered only 48 m at such speeds. Additionally, the Giovanissimi 2007 covered 136 m in acceleration phases exceeding 3 m/s², whereas the Giovanissimi 2008 covered 57 m under similar conditions. In deceleration phases below -3 m/s², the Giovanissimi 2007 covered 146 m, compared to 78 m by the Giovanissimi 2008. Neither team surpassed a speed of 24 km/h during their respective training sessions. The maximum speed recorded for the Giovanissimi 2007 was 23.76 km/h, whereas for the Giovanissimi 2008, it was 19.44 km/h.

Training Sessions on April 1 and March 30



Graph 6. Comparison of Training on April 1: Giovanissimi 2007 vs. March 30: Giovanissimi 2008

Table 8. Training on March 18: Giovanissimi 2007 (LEFT) 2008 (RIGHT)

Table 9. Training on March 18: Giovanissimi

COACH'S WARM-UP													
	D	D_SHI	D_S5	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56
Team Average	1371	55	23	10	12	2	0:12:23	0	0:00:06	0:00:05	5,7	0	0
Athlete 14	1388	87	46	12	11	2	0:12:23	1	0:00:09	0:00:04	6,6	0	0
Athlete 15	1354	23	0	7	13	1	0:12:23	0	0:00:04	0:00:06	4,8	0	0

COACH'S WARM UP													
	D	D_SHI	D_S5	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56
Team Average	678	0	0	12	19	2	0:15:55	2	0:00:07	0:00:09	3,8	0	0
Athlete 17	723	0	0	15	24	1	0:15:55	2	0:00:09	0:00:12	3,9	0	0
Athlete18	633	0	0	9	13	2	0:15:55	2	0:00:05	0:00:07	3,6	0	0

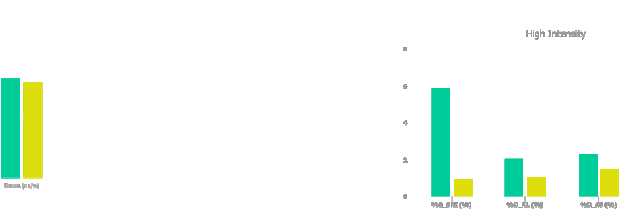
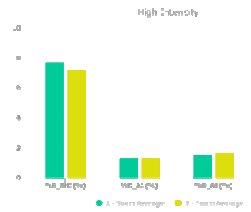
The Giovanissimi 2007 underwent a training session lasting 1 hour and 24 minutes, covering a distance of 6 km and 656 m; whereas the Giovanissimi 2008 trained for 1 hour and 16 minutes, covering 5 km and 486 m. The Giovanissimi 2007 covered a distance exceeding 16 km/h for 510 m, contrasting with 414 m covered by the Giovanissimi 2008. In terms of acceleration, the Giovanissimi 2007 covered 82 m above 3 m/s², while the Giovanissimi 2008 covered 75 m. Similarly, the deceleration distance below -3 m/s² for the Giovanissimi 2007 was 97 m compared to 95 m for the Giovanissimi 2008. The maximum speed attained by the Giovanissimi 2007 was 25.2 km/h, whereas for the Giovanissimi 2008, it was 26.64 km/h.

On April 22nd and 21st, the Giovanissimi 2007 trained for 1 hour and 17 minutes, covering 5 km and 145 m; while the Giovanissimi 2008 trained for 1 hour and 11 minutes, covering 5 km and 441 m. The Giovanissimi 2007 covered a distance exceeding 16 km/h for 188 m, compared to 209 m for the Giovanissimi 2008. Regarding acceleration, the Giovanissimi 2007 covered 97 m above 3 m/s², whereas the Giovanissimi 2008 covered 66 m. In terms of deceleration, the Giovanissimi 2007 covered 106 m below -3 m/s², while the Giovanissimi 2008 covered 85 m. The maximum speed attained by the Giovanissimi 2007 was 24.48 km/h, while for the Giovanissimi 2008, it was 24.12 km/h.

Comparison between Allievi 2005 and Allievi 2006

Team Average 1 corresponds to Allievi 2005, while Team Average 2 corresponds to Allievi 2006.

Matches on March 13th and 19th



Graph 7. Comparison of Training on March 18: Giovanissimi 2007 vs. Giovanissimi 2008

Graph 8. Comparison of Training on April 1: Giovanissimi 2007 vs. March 30: Giovanissimi 2008

Table 10. Match on March 13th: Allievi 2005 2006

Table 11. Match on March 19th: Allievi

FIRST HALF													
	D	D_SHI	D_S5	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56
Team Average	5370	686	146	99	111	23	0:47:18	13	0:00:43	0:00:44	12:00:00	0:00:00	2
Athlete 9	5240	533	118	74	108	18	0:47:18	13	0:00:34	0:00:43	7:12:00	0:00:00	2
Athlete 8	5900	839	174	124	114	27	0:47:18	13	0:00:53	0:00:45	16:48:00	0:00:00	1

FIRST HALF													
	D	D_SHI	D_S5	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_56	NU_56
Team Average	5315	560	102	60	75	19	0:47:33	14	0:00:29	0:00:29	7,4	36	3
Athlete 12	5384	510	77	88	112	23	0:47:33	21	0:00:07	0:00:42	6,6	0	0
Athlete 10	5501	1075	200	68	56	29	0:47:33	18	0:00:50	0:00:23	8,3	78	5
Athlete 11	5061	313	78	41	37	5	0:47:33	3	0:00:20	0:00:23	7,7	30	3

In these matches, we observe the Allievi 2005 covering a greater distance compared to the Allievi 2006 in both the first and second halves, with both categories decreasing in the latter half. The same holds true for the distance covered at high intensity above 16 km/h, the number of accelerations above 3 m/s², and the decelerations below -3 m/s². As for the distance covered above 24 km/h, in the first half, the Allievi 2006 record a higher distance, while in the second half, the data for the Allievi 2006 decrease and are lower than those of the Allievi 2005, which increase compared to the first half. The maximum speed in this match is achieved by Athlete 10 (Allievi 2006) in the first half, reaching 29.88 km/h.

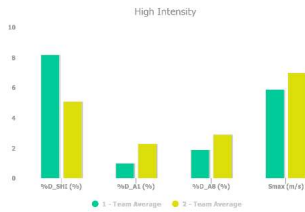
Match on March 27th and April 2nd

In this match, we see the Allievi 2005 and the Allievi 2006 covering the same distance in the first half, then the Allievi 2006 decrease in the second half while the Allievi 2005 increase. The distance covered at high intensity above 16 km/h is always greater for the Allievi 2005, and for both categories, it decreases in the second half. The number of accelerations above 3 m/s² is higher in the Allievi 2005, and while it remains almost the same for them between the first and second halves, it decreases for the Allievi 2006 in the second half. The same applies to the decelerations below -3 m/s². As for the distance covered above 24 km/h, it is always greater for the Allievi 2005 in both the first and second halves, but decreases in the latter half for both categories. The maximum speed in this match is achieved by Athlete 12 (Allievi 2006) in the first half, reaching 27.72 km/h.

Match on May 1st and April 29th

In this match, we see an identical first half between the Allievi 2005 and the Allievi 2006, but the Allievi 2005 maintain the same distance even in the second half, while the Allievi 2006 decrease. The distance covered at high intensity above 16 km/h is always greater for the Allievi 2005, but increases in both categories in the second half. The number of accelerations above 3 m/s² is higher in the Allievi 2005, and while it increases in the second half for them, it decreases for the Allievi 2006. The decelerations below -3 m/s² are greater in the Allievi 2005 and decrease for both categories in the second half. As for the distance covered above 24 km/h, it is always greater for the Allievi 2005, but they experience a decrease in the second half, while that of the Allievi 2006 increases in the latter half. The maximum speed in this match is achieved by Athlete 7 (Allievi 2005) in the first half, reaching 30.24 km/h.

Training on March 8th and March 9th



Graph 9. Comparison of Training Sessions on March 8th: Allievi 2005 and March 9th: Allievi 2006

Table 12. Training Session on March 8: Under-15s 2005

VALENTINI'S WARM UP													
D	D_SMI	D_S5	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Stmax	D_S6	NU_S6	
Team Average	330	60	15	3	6	0	00:13:48	0	00:00:02	00:00:03	5.7	0	0
Allievi 2005	930	67	3	2	6	0	00:13:48	0	00:00:01	00:00:02	5.8	0	0
Allievi 2006	747	21	0	0	1	0	00:13:48	0	00:00:00	00:00:00	5	0	0
Allievi 7	922	29	29	8	12	0	00:13:48	0	00:00:04	00:00:04	5.6	0	0

Table 13. Training Session on March 9: Under-15s 2006

COACH'S WARM UP													
D	D_SMI	D_S5	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Stmax	D_S6	NU_S6	
Team Average	751	47	7	9	16	3	00:07:52	6	00:00:54	00:00:07	5.4	0	0
Allievi 12	714	42	0	11	14	3	00:07:52	4	00:00:05	00:00:06	5.3	0	0
Allievi 10	751	43	14	6	18	3	00:07:52	6	00:00:03	00:00:07	5.0	0	0

The Allievi 2005 engage in a training session lasting 1 hour and 15 minutes, covering a distance of 5 km and 961 m. Conversely, the Allievi 2006 dedicate 1 hour and 22 minutes to their training, traversing a distance of 5 km and 613 m. Notably, the Allievi 2005 surpass their counterparts in distances covered above 16 km/h, totaling 489 m compared to the Allievi 2006's 319 m. Additionally, the Allievi 2005 exhibit shorter distances in acceleration above 3 m/s², measuring 68 m in contrast to the Allievi 2006's 105 m. However, the Allievi 2006 demonstrate a greater distance covered in deceleration below -3 m/s², spanning 144 m compared to the Allievi 2005's 101 m. The maximum speed attained by the Allievi 2005 peaks at 23.04 km/h, never exceeding the 24 km/h mark, while the Allievi 2006 achieve a maximum speed of 25.2 km/h.

Training Sessions on March 25th and 23rd

During their training session lasting 1 hour and 18 minutes, the Allievi 2005 cover a distance of 4 km and 314 m, whereas the Allievi 2006 dedicate 1 hour and 15 minutes, covering a distance of 5 km and 263 m. The Allievi 2005 maintain a lead in distances covered above 16 km/h, tallying 209 m compared to the Allievi 2006's 212 m. Furthermore, the Allievi 2005 record a shorter distance in acceleration above 3 m/s² at 51 m,

contrasting with the Allievi 2006's 69 m. In deceleration below -3 m/s^2 , the Allievi 2005 cover 75 m compared to the Allievi 2006's 104 m. The maximum speed achieved by the Allievi 2005 reaches 24.12 km/h, while the Allievi 2006 reach 25.56 km/h.

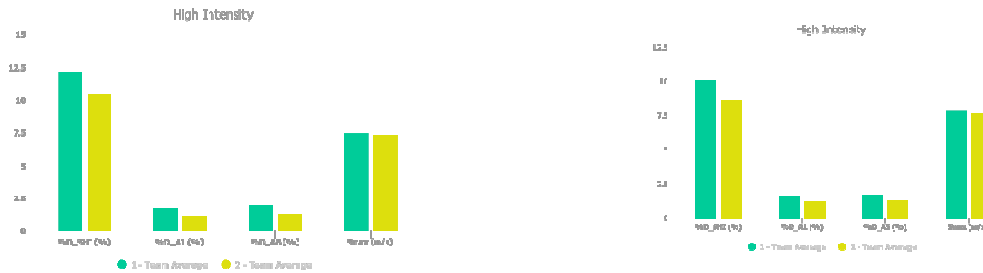
Training Sessions on April 26th and 27th

During their training session lasting 1 hour and 27 minutes, the Allievi 2005 cover a distance of 6 km and 79 m, whereas the Allievi 2006 dedicate 1 hour and 22 minutes, covering a distance of 5 km and 881 m. The Allievi 2005 maintain their lead in distances covered above 16 km/h, recording 595 m compared to the Allievi 2006's 345 m. Additionally, the Allievi 2005 exhibit a shorter distance in acceleration above 3 m/s^2 at 70 m, contrasting with the Allievi 2006's 86 m. In deceleration below -3 m/s^2 , the Allievi 2005 cover 102 m compared to the Allievi 2006's 111 m. The maximum speed attained by the Allievi 2005 reaches 24.84 km/h, while the Allievi 2006 peak at 26.64 km/h.

Comparison between Prima Squadra and Juniores

Team Average 1 corresponds to the Prima Squadra, while Team Average 2 corresponds to the Juniores.

Match on March 6th and 12th



Graph 10. Comparison of First Half: March 13th, Allievi 2005 (LEFT) **Graph 11.** Comparison of Second Half: March 13th, Allievi 2005 (RIGHT)

Table 14. Match on March 6th - Prima Squadra (LEFT)

Table 15. Match on March 12th - Juniores (RIGHT)

FIRST HALF													FIRST HALF														
D	D_SHI	D_S5	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_S6	NU_S6	D	D_SHI	D_S5	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_S6	NU_S6		
Team Average	6133	915	182	82	81	26	00:47:58	15	00:00:37	00:00:33	7.3	26	2	Team Average	6133	915	182	82	81	26	00:47:58	15	00:00:37	00:00:33	7.3	26	2
Athlete 2	5839	767	207	87	85	23	00:47:58	14	00:00:40	00:00:34	7.2	19	2	Athlete 2	5839	767	207	87	85	23	00:47:58	14	00:00:40	00:00:34	7.2	19	2
Athlete 1	6426	1063	157	77	76	28	00:47:58	16	00:00:33	00:00:32	7.4	34	2	Athlete 1	6426	1063	157	77	76	28	00:47:58	16	00:00:33	00:00:32	7.4	34	2
SECOND HALF													SECOND HALF														
D	D_SHI	D_S5	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_S6	NU_S6	D	D_SHI	D_S5	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Smax	D_S6	NU_S6		
Team Average	5967	835	156	62	62	17	00:50:57	10	00:00:28	00:00:25	6.7	23	3	Team Average	5967	835	156	62	62	17	00:50:57	10	00:00:28	00:00:25	6.7	23	3
Athlete 2	5967	805	175	68	70	17	00:50:57	12	00:00:31	00:00:28	7.3	32	4	Athlete 2	5967	805	175	68	70	17	00:50:57	12	00:00:31	00:00:28	7.3	32	4
Athlete 1	2323	354	43	18	16	6	00:19:49	2	00:00:08	00:00:07	6.2	0	0	Athlete 1	2323	354	43	18	16	6	00:19:49	2	00:00:08	00:00:07	6.2	0	0

In this match, we observe that the distance covered by the Prima Squadra is consistently higher than that of the Juniores, with both teams experiencing a decline during the second half. The high-intensity distance covered above 16 km/h is greater in the first half for the Prima Squadra, but decreases in the second half and is narrowly surpassed by the Juniores. The number of accelerations above 3 m/s^2 is slightly higher in the first half for the Prima Squadra, then becomes identical in the second half with a decline from both teams. Decelerations below -3 m/s^2 are nearly identical in both halves for both teams. As for the distance covered above 24 km/h, it is much higher for the Juniores. The maximum speed in this match is achieved by Athlete 6 (Juniores) in the second half, reaching 30.60 km/h.

Match on April 3rd and March 26th

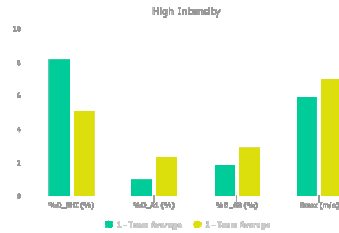
In this match we see that the distance covered by the Prima Squadra is consistently higher than that of the Juniores. For the Prima Squadra, this remains the same between the first and second halves, while it slightly decreases for the Juniores. The high-intensity distance covered above 16 km/h is consistently greater for the Prima Squadra, but has a slight decrease in the second half, while the Juniores have a small increase in the second half. The number of accelerations above 3 m/s^2 remains the same between the Prima Squadra and Juniores except in the second half, where the number increases for the Prima Squadra while remaining unchanged for the Juniores. Decelerations below -3 m/s^2 are nearly identical in the first half, but increase for the Prima Squadra and decrease for the Juniores in the second half. As for the distance covered above 24 km/h, it is much higher for the Prima Squadra, and decreases in the second half for both teams. The maximum speed in this match is achieved by Athlete 3 (Prima Squadra) in the first half, reaching 30.96 km/h.

Match on April 9th and 24th

In this match we observe that the distance covered by the Prima Squadra is consistently higher than that of the Juniores, and while the Prima Squadra increases in the second half, the Juniores experience a significant decline. The high-intensity distance covered above 16 km/h is consistently greater for the Prima Squadra, maintaining roughly the same level between the first and second halves, while that of the Juniores decreases. The number of accelerations above 3 m/s^2 is similar, but higher for the Juniores; both categories decrease in the

second half. Decelerations below -3 m/s^2 for the Juniores are always greater, and both categories decrease in the second half, as does the distance covered above 24 km/h . The maximum speed in this match is achieved by Athlete 6 (Juniores) in the second half, reaching 31.32 km/h .

Training on March 8th and March 9th



Graph 12. Training Comparison: March 9 Prima Squadra and March 8 Juniores

Table 16. Training Session of Prima Squadra - March 9

COACH'S WARM UP													
D	D_5H1	D_5S	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Spmax	D_56	NU_56	
Team	758	25	0	1	2	0	00:10:21	0	00:00:00	00:00:00	4.9	0	0
Athleta 3	654	1	0	3	4	1	00:10:21	0	00:00:01	00:00:01	4.5	0	0
Athleta 2	782	30	0	2	3	0	00:10:21	0	00:00:00	00:00:01	5.2	0	0
Athleta 1	618	28	0	0	1	0	00:10:21	0	00:00:00	00:00:00	5.1	0	0

Table 17. Training Session of Juniores -

WARM UP WITH VALENTINI													
D	D_5H1	D_5S	D_A1	D_AB	ND_A1	T	NU_AB	T_A1	T_AB	Spmax	D_56	NU_56	
Team	354	17	0	4	9	1	00:05:11	2	00:00:04	00:00:04	5	0	0
Athleta 5	355	8	0	0	13	2	00:05:11	2	00:00:06	00:00:07	5.4	0	0
Athleta 6	358	0	0	6	7	0	00:05:11	0	00:00:05	00:00:04	4.4	0	0
Athleta 4	288	13	0	2	4	0	00:05:11	2	00:00:01	00:00:03	5.3	0	0

The Prima Squadra undergoes a training session lasting 1 hour and 31 minutes, covering a distance of 6 kilometers and 38 meters; the Juniores train for 1 hour and 27 minutes, covering 5 kilometers and 946 meters. The Prima Squadra travels a distance above 16 km/h for 483 meters, compared to the Juniores' 287 meters. The distance covered in acceleration above 3 m/s^2 by the Prima Squadra is 107 meters, while for the Juniores, it is 141 meters. The distance covered in deceleration below -3 m/s^2 is 152 meters for the Prima Squadra and 194 meters for the Juniores. The maximum speed reached by the Prima Squadra is 28.8 km/h , whereas for the Juniores, it is 27.72 km/h .

Training on March 31st and 29th

The Prima Squadra engages in a training session lasting 1 hour and 24 minutes, covering a distance of 7 kilometers and 21 meters; the Juniores train for 1 hour and 21 minutes, covering 5 kilometers and 60 meters. The Prima Squadra travels a distance above 16 km/h for 767 meters, compared to the Juniores' 171 meters. The distance covered in acceleration above 3 m/s^2 by the Prima Squadra is 79 meters, while for the Juniores, it is 94 meters. The distance covered in deceleration below -3 m/s^2 is 98 meters for the Prima Squadra and 154 meters for the Juniores. The maximum speed reached by the Prima Squadra is 27.72 km/h , whereas for the Juniores, it is 25.92 km/h .

Training on April 27th and 26th

The Prima Squadra partakes in a training session lasting 1 hour and 23 minutes, covering a distance of 6 kilometers and 575 meters; the Juniores train for 1 hour and 31 minutes, covering 6 kilometers and 885 meters. The Prima Squadra travels a distance above 16 km/h for 489 meters, compared to the Juniores' 381 meters. The distance covered in acceleration above 3 m/s^2 by the Prima Squadra is 84 meters, while for the Juniores, it is 134 meters. The distance covered in deceleration below -3 m/s^2 is 112 meters for the Prima Squadra and 185 meters for the Juniores. The maximum speed reached by the Prima Squadra is 27.72 km/h , whereas for the Juniores, it is 27.36 km/h .

Discussion

The analysis was conducted in pairs, beginning with the Giovanissimi 2008 and 2007, followed by the Allievi 2006 and 2005, the Juniores, and the Prima Squadra. Finally, the comparison spanned from the earliest to the latest age groups, highlighting the overall physical evolution of midfielders in competitive activity. Before delving into the comparison between the Giovanissimi 2008 and 2007, it is crucial to specify that between these

two age groups (as well as among the others), the distinction is not always clear. In many clubs, especially smaller ones, these two age groups play together and are not enrolled in separate leagues, forming a single team. It's evident that by playing together, the data may be substantially correlated.

Comparison between Giovanissimi 2008 and Giovanissimi 2007 Matches

The athletes of Giovanissimi 2008 have an average age of 13.6 years, weigh 62 kg, and are 1.70 meters tall, while the athletes of Giovanissimi 2007 have an average age of 15 years, weigh 61 kg, and are 1.71 meters tall. The average total distance covered in the first half by the Giovanissimi 2008 is 3 km and 268 meters, whereas that covered by the Giovanissimi 2007 is 3 km and 608 meters. As for the second half, the Giovanissimi 2008 cover an average distance of 3 km and 42 meters, while the Giovanissimi 2007 cover 3 km and 313 meters on average. When analyzing the average kilometers covered throughout the matches, the Giovanissimi 2008 cover 6 km and 310 meters, while the Giovanissimi 2007 cover 6 km and 921 meters. Hence, we observe that, albeit with a slight difference, the Giovanissimi 2007 cover more meters during the matches, and both categories experience a decline in the second half. The average distance covered above 16 km/h in the first half by the Giovanissimi 2008 is 177 meters, while that of the Giovanissimi 2007 is 256 meters. In the second half, the Giovanissimi 2008 cover an average of 152 meters above 16 km/h, whereas the Giovanissimi 2007 cover 230 meters. Throughout the entire match, the Giovanissimi 2008 cover 329 meters above 16 km/h, whereas the Giovanissimi 2007 cover 486 meters. Even concerning the distance covered at high intensity above 16 km/h, the data for the Giovanissimi 2007 are consistently higher, although not significantly, and there is a small decline for both categories in the second half. The distance covered in deceleration below -3 m/s^2 in the first half is 37 meters for the Giovanissimi 2008 and 56 meters for the Giovanissimi 2007. During the second half, the Giovanissimi 2008 cover 40 meters in deceleration, while the Giovanissimi 2007 cover 42 meters. The average deceleration distance for the entire match is 77 meters for the Giovanissimi 2008 and 98 meters for the Giovanissimi 2007. Again, in this case, the data for the Giovanissimi 2007 are slightly higher, and while there is a decline for them in the second half, the Giovanissimi 2008 show a slight increase during the second half concerning this data. The distance covered in acceleration above 3 m/s^2 in the first half is 36 meters for the Giovanissimi 2008 and 53 meters for the Giovanissimi 2007. During the second half, the Giovanissimi 2008 cover 41 meters in acceleration, while the Giovanissimi 2007 cover 46 meters. The average acceleration distance for the entire match is 77 meters for the Giovanissimi 2008 and 99 meters for the Giovanissimi 2007. Once again, the data for the Giovanissimi 2007 are slightly higher, and while there is a decline for them in the second half, the Giovanissimi 2008 show a slight increase during the second half concerning this data. Moreover, we can notice that the data for decelerations and accelerations within the same category are almost identical, which helps us establish that in these categories evaluated, athletes accelerate and decelerate more or less equally. The average maximum speed achieved in the first half by the Giovanissimi 2008 is 21.96 km/h, while for the Giovanissimi 2007, it is 23.76 km/h. In the second half, the Giovanissimi 2008 reached 22.68 km/h, whereas the Giovanissimi 2007 reached 25.32 km/h. Therefore, the total average maximum speed for the Giovanissimi 2008 is 22.32 km/h, and for the Giovanissimi 2007, it is 24.54 km/h. The maximum peak speed reached by the Giovanissimi 2008 is 25.92 km/h, while for the Giovanissimi 2007, it is 29.16 km/h. These data demonstrate that concerning maximum speed, the Giovanissimi 2007 consistently show higher values, and in both categories, athletes achieve higher speeds during the second half.

Comparison between Giovanissimi 2008 and Giovanissimi 2007 Training Sessions

The Giovanissimi 2008 and Giovanissimi 2007 undergo training sessions with the same timing; indeed, the former train on average for 1 hour and 17 minutes, and the latter for 1 hour and 16 minutes. During a training session, the Giovanissimi 2008 cover an average distance of 5 km and 407 meters, whereas the Giovanissimi cover 6 km and 45 meters. Of these, the Giovanissimi 2008 cover 223 meters at high intensity above 16 km/h, while the Giovanissimi 2007 cover 356 meters. Regarding the deceleration distance below -3 m/s^2 , the Giovanissimi 2008 cover 66 meters, whereas the Giovanissimi 2007 cover 105 meters. The acceleration distance above 3 m/s^2 for the Giovanissimi 2008 is 86 meters, against the 166 meters of the Giovanissimi 2007. The average maximum speed achieved by the Giovanissimi 2008 is 21.48 km/h, while the Giovanissimi 2007 reach 22.92 km/h.

Comparison between Allievi 2006 and Allievi 2005 Matches

The athletes in the Allievi 2006 category are, on average, 16 years old, weigh 73 kg, and are 1.79 m tall, whereas those in the Allievi 2005 category are, on average, 17 years old, weigh 63 kg, and are 1.72 m tall. The average total distance covered in the first half by the Allievi 2006 is 5 km and 200 m, while the Allievi 2005 cover 5 km and 315 m. In the second half, the Allievi 2006 average 4 km and 639 m, while the Allievi 2005 cover 5 km and 273 m. Analyzing the average distance covered throughout the entire match, the Allievi 2006 cover 9 km and 839 m, whereas the Allievi 2005 cover 10 km and 588 m. Thus, we see that although the difference is slight, the Allievi 2005 cover more meters during matches, and both categories experience a decrease in the second half. The average distance covered above 16 km/h by the Allievi 2006 in the first half is 434 m, while the Allievi 2005 cover 661 m. In the second half, the Allievi 2006 average 375 m above 16 km/h, while the Allievi 2005 cover 582 m. Throughout the entire match, the Allievi 2006 cover 809 m above 16 km/h, while the Allievi 2005 cover 1248 m. Even in terms of high-intensity distance covered above 16 km/h, the Allievi 2005 consistently show higher figures, although not by much, and there is a slight decline for both

categories in the second half. The distance covered in deceleration below -3 m/s^2 by the Allievi 2006 in the first half is 65 m, while for the Allievi 2005, it is 90 m. During the second half, the Allievi 2006 cover 58 m in deceleration, while the Allievi 2005 cover 90 m. The average for the entire match is 123 m for the Allievi 2006, compared to 180 m for the Allievi 2005. Here too, the Allievi 2005 figures are significantly higher, and while they do not show a decline in the second half (maintaining equal figures between the first and second halves), the Allievi 2006 do. The distance covered in acceleration above 3 m/s^2 by the Allievi 2006 in the first half is 72 m, while for the Allievi 2005, it is 101 m. During the second half, the Allievi 2006 cover 58 m in acceleration, while the Allievi 2005 cover 90 m. The average for the entire match is 130 m for the Allievi 2006, compared to 191 m for the Allievi 2005. Once again, the Allievi 2005 figures are consistently higher, and both categories experience a decline in the second half. The average maximum speed reached in the first half by the Allievi 2006 is 25.68 km/h, whereas for the Allievi 2005, it is 27.72 km/h. In the second half, the Allievi 2006 reach 25.8 km/h, while the Allievi 2005 reach 27.12 km/h. Thus, the overall average maximum speed for the Allievi 2006 is 25.74 km/h, while for the Allievi 2005, it is 27.42 km/h. The peak maximum speed reached by the Allievi 2006 is 29.88 km/h, compared to 30.24 km/h for the Allievi 2005. These figures demonstrate that, even regarding maximum speed, the Allievi 2005 consistently have higher figures, and athletes in both categories maintain very similar maximum speeds between the first and second halves.

Comparison between Allievi 2006 and Allievi 2005 Training Sessions

The Allievi 2006 and Allievi 2005 have training sessions of the same duration; the former train for an average of 1 hour and 20 minutes, while the latter train for 1 hour and 19 minutes. During a training session, the Allievi 2006 cover an average of 5 km and 585 m, whereas the Allievi 2005 cover 5 km and 451 m. Of these, the Allievi 2006 cover 292 m at high intensity above 16 km/h, while the Allievi 2005 cover 431 m. Regarding meters in deceleration below -3 m/s^2 , the Allievi 2006 cover 87 m, while the Allievi 2005 cover 63 m; the meters in acceleration above 3 m/s^2 covered by the Allievi 2006 are 120, compared to 93 m by the Allievi 2005. The average maximum speed reached by the Allievi 2006 is 24.48 km/h, while the Allievi 2005 reach 23.04 km/h.

Comparison between Juniores and Prima Squadra Matches

The athletes in the Juniores category are, on average, 19 years old, weigh 72 kg, and are 1.75 m tall, while those in the Prima Squadra are, on average, 22.6 years old, weigh 71 kg, and are 1.78 m tall. The average total distance covered in the first half by the Juniores is 5 km and 241 m, whereas the Prima Squadra cover 5 km and 788 m. In the second half, the Juniores average 5 km and 89 m, while the Prima Squadra cover 5 km and 818 m. Analyzing the average distance covered throughout the entire match, the Juniores cover 10 km and 318 m, while the Prima Squadra cover 11 km and 606 m. Therefore, we see that the Prima Squadra cover more than 1 km more compared to the Juniores, with a slight decline in the second half for the latter, while the Prima Squadra experience a small increase during the second half. The average distance covered above 16 km/h by the Juniores in the first half is 643 m, while the Prima Squadra cover 951 m. In the second half, the Juniores average 632 m above 16 km/h, while the Prima Squadra cover 913 m. Throughout the entire match, the Juniores cover 1 km and 275 m above 16 km/h, while the Prima Squadra cover 1 km and 864 m. Even in terms of high-intensity distance covered above 16 km/h, the Prima Squadra consistently show higher figures. The distance covered in deceleration below -3 m/s^2 by the Juniores in the first half is 84 m, while for the Prima Squadra, it is 80 m. During the second half, the Juniores cover 74 m in deceleration, and the Prima Squadra also cover 74 m. The average for the entire match for the Juniores is 158 m, while for the Prima Squadra, it is 154 m. In this case, the figures for the Juniores are slightly higher, and both categories experience a slight decline in the second half. The distance covered in acceleration above 3 m/s^2 by the Juniores in the first half is 89 m, while for the Prima Squadra, it is 82 m. During the second half, the Juniores cover 74 m in acceleration, while the Prima Squadra cover 76 m. The average for the entire match for the Juniores is 163 m, while for the Prima Squadra, it is 158 m. Here again, the figures for the Juniores are always slightly higher, and both categories experience a slight decline in the second half. What we notice between these two categories is that the acceleration and deceleration figures are very similar to each other. The average maximum speed reached in the first half by the Juniores is 27.6 km/h, while for the Prima Squadra, it is 27.36 km/h. In the second half, the Juniores reach 27.6 km/h, while the Prima Squadra reach 26.88 km/h. Thus, the overall average maximum speed for the Juniores is 27.6 km/h, remaining constant between the first and second halves, while for the Prima Squadra, it is 27.12 km/h, with a slight decline during the second half. The peak maximum speed reached by the Juniores is 30.6 km/h, compared to 30.96 km/h for the Prima Squadra. These figures demonstrate that even in terms of maximum speed, the two categories are very similar, but the Juniores have slightly higher values.

Comparison between Juniores and Prima Squadra Training Sessions

The Juniores and Prima Squadra have training sessions of the same duration; indeed, both train for an average of 1 hour and 26 minutes. During a training session, the Juniores cover an average of 5 km and 963 m, while the Prima Squadra covers 6 km and 544 m. Of these, the Juniores cover 279 m at high intensity above 16 km/h, while the Prima Squadra covers 579 m. Regarding meters in deceleration below -3 m/s^2 , the Juniores cover 123 m, while the Prima Squadra covers 90 m; the meters in acceleration above 3 m/s^2 covered by the Juniores are 178, compared to 121 m by the Prima Squadra. The average maximum speed reached by the Juniores is 24.48 km/h, while the Prima Squadra reaches 26.64 km/h.

Conclusions

Conclusion from Match Data Analysis

For all the data analyzed during the matches of the Giovanissimi 2008 and Giovanissimi 2007, we see that the results of the Giovanissimi 2007 are always slightly higher. This could be supported by various factors, primarily age, and consequently, physical development and muscle development. However, it is also essential to consider that the Giovanissimi 2007 are in their second year of competitive activity, while the Giovanissimi 2008 are only in their first. This means that until a year earlier, these athletes did not play on the full field but on a smaller portion with different playing time (3 halves of 20 minutes), and on the field, both teams played 9 versus 9 (while in competitive play, they switch to 11 versus 11). Regarding all the data analyzed during the matches of the Allievi 2006 and Allievi 2005, we see that the results of the Allievi 2005 are always slightly higher. This could be supported by various factors, including age. Consequently, physical, psychological, athletic, and motor development, as well as muscle development. However, it is also essential to consider that the Allievi 2006 are in their fourth year of competitive activity, and therefore, it is the second year in which they play 2 halves of 45 minutes, while the Allievi 2005 are in their third year, and this means that until the previous year, they played 2 halves of 35 minutes, so they may be accustomed differently, especially in terms of energy expenditure and distribution during the entire match. Finally, for the data analyzed during matches of the Prima Squadra and Juniores, we see that the Prima Squadra covers more kilometers during matches and, compared to the Juniores, covers more at high intensity above 16 km/h. Acceleration and deceleration data are slightly higher for the Juniores but with a little significant difference; therefore, we can state that the Prima Squadra and Juniores cover the same space in acceleration and deceleration. Regarding maximum speed, that of the Juniores is slightly higher, but the peak maximum is reached by a player from the Prima Squadra. Here too, it is essential to say that the difference between these two categories should be minimal because the Prima Squadra draws on Juniores players, and therefore, all three midfielders of the Juniores could be called up for training or matches with the Prima Squadra (something that actually happened sporadically during the season).

Overall Comparison of Matches Across All Six Categories

Table 18. Overall Comparison of Matches Across All Six Categories

	Giov. 2008	Giov. 2007	All. 2006	All. 2005	Juniores	Prima sq.
D 1°T	3.268 km	3.608 km	5.200 km	5.315 km	5.241 km	5.788 km
D 2°T	3.042 km	3.313 km	4.639 km	5.273 km	5.077 km	5.818 km
D tot.	6.310 km	6.921 km	9.839 km	10.588 km	10.318 km	11.606 km
D_SHI 1°T	177 m	256 m	434 m	661 m	643 m	951 m
D_SHI 2°T	152 m	230 m	375 m	582 m	632 m	913 m
D_SHI tot.	329 m	486 m	809 m	1.243 km	1.275 km	1.864 km
D_A1 1°T	37 m	56 m	65 m	90 m	84 m	80 m
D_A1 2°T	40 m	42 m	58 m	90 m	74 m	74 m
D_A1 tot.	77 m	98 m	123 m	180 m	158 m	154 m
D_A8 1°T	36 m	53 m	72 m	101 m	89 m	82 m
D_A8 2°T	41 m	46 m	58 m	90 m	74 m	76 m
D_A8 tot.	77 m	99 m	130 m	191 m	163 m	158 m
Smax 1°T	21.96 km/h	23.76 km/h	25.68 km/h	27.72 km/h	27.6 km/h	27.36 km/h
Smax 2°T	22.68 km/h	25.32 km/h	25.8 km/h	27.12 km/h	27.6 km/h	26.88 km/h
Smax tot.	22.32 km/h	24.54 km/h	25.74 km/h	27.42 km/h	27.6 km/h	27.12 km/h
Max vel.	25.92 km/h	29.16 km/h	29.88 km/h	30.24 km/h	30.6 km/h	30.96 km/h

Overall Comparison of Matches Across All Six Categories

Table 18 summarizes all the previously discussed data for a comprehensive and immediate overview of the findings. Below, parameter by parameter, we detail the results for the various categories.

When considering the overall comparison, we will now examine which category obtained the best results for each parameter. Regarding distance (distance in the first half, second half, and total), we find that the category covering the most kilometers is consistently the Prima Squadra, followed by the Allievi 2005, and then the Juniores. As for the distance covered at high intensity (>16 km/h), we also consistently find higher data for the Prima Squadra. However, in the first half, the second-place data belongs to the Allievi 2005, while in the second half and over the entire match, it belongs to the Juniores. An unexpected result is found in the accelerations above 3 m/s² and decelerations below -3 m/s², where the Allievi 2005 consistently rank first,

followed by Juniores and Prima Squadra, which are more or less equivalent. Additionally, we always find the Allievi 2005 leading when it comes to maximum speed in the first half. However, regarding the second half and the entire match, the best data belongs to the Juniores. Thus, the Prima Squadra consistently ranks third in terms of average maximum speed during the match. However, the highest recorded data in all matches are from a player of the Prima Squadra who reached 30.96 km/h.

In conclusion, for the first three years: Giovanissimi 2008, Giovanissimi 2007, and Allievi 2006, there is a gradual progression without any particular surprises or unexpected data. However, for the other three categories, the data is very surprising, as seen above. It is worth considering that these data were collected over three months and, therefore, in our opinion, would require further data for an even more significant comparison among them.

Conclusion from Training Data Analysis

In conclusion, when averaging the training sessions of the Giovanissimi 2008 and Giovanissimi 2007 analyzed, all the data from the Giovanissimi 2007 are slightly higher. This confirms the data we observed in the matches, as maintaining higher intensity in training can help maintain higher intensity in matches. Regarding the Allievi 2005 and Allievi 2006, when averaging the analyzed training sessions, all the data from the Allievi 2006 are slightly higher, except for the data regarding distance covered at high intensity above 16 km/h. These results are quite unexpected when compared to the previous match data, where the highest data were always from the Allievi 2005. Considering that in matches, the aim is to give the maximum effort, this could mean that the Allievi 2005 potentially could achieve better data than the Allievi 2006, but in training, they do not reach their maximum potential, probably due to their age (17 years), which sometimes leads some of the boys to do things not optimally, occasionally with excessive ease.

Table 19. Overall Comparison of Training Across All Six Categories

	Giov. 2008	Giov. 2007	All. 2006	All. 2005	Juniores	Prima sq.
D	5.407 km	6.045 km	5.585 km	5.451 km	5.963 km	6.544 km
D_SHI	223 m	356 m	292 m	431 m	279 m	579 m
D_A1	66 m	105 m	87 m	63 m	123 m	90 m
D_A8	86 m	116 m	120 m	93 m	178 m	121 m
Smax	21.48 km/h	22.92 km/h	24.48 km/h	23.04 km/h	24.48 km/h	26.64 km/h
T	1 h 17 m	1 h 16 m	1 h 19 m	1 h 20 m	1 h 26 m	1 h 26 m

Finally, when averaging the training sessions of the Prima Squadra and Juniores analyzed, the Prima Squadra covers more kilometers and covers more space at high intensity above 16 km/h, while the Juniores have higher data for accelerations and decelerations. Additionally, the data for maximum speed is higher for the Prima Squadra. In this specific case, it is essential to specify the training conditions of the Juniores: the Prima Squadra needs to have every training session with 22 athletes throughout the season, meaning that in each training session, they draw from the Juniores team, which can range from 2 to 3 players, but even more in case of absences due to injury in the Prima Squadra. This means that the Juniores often find themselves training with a low number of athletes, which can have a negative influence on performance and consequently reflect on the data.

Overall Comparison of Training Across All Six Categories

When it comes to distance, we see that during training sessions, it's the players of the Prima Squadra who cover the most, followed by the Giovanissimi 2007 and the Juniores. Concerning high-intensity distance, the Prima Squadra is consistently at the forefront, followed by the Allievi 2005 and the Giovanissimi 2007. The most significant accelerations above 3 m/s² are executed by the Juniores, followed by the Giovanissimi 2007 and the Prima Squadra. Regarding decelerations below 3 m/s², the Juniores consistently lead, followed by the Prima Squadra and then the Allievi 2006. The highest average maximum speed is found in the Prima Squadra, followed by the Juniores and the Allievi 2006. Lastly, all six categories train for a duration exceeding 1 hour and 15 minutes but less than 1 hour and 30 minutes.

In conclusion, from these data, we see that although the Giovanissimi 2007 do not stand out among match data, the training results are very promising, which could be a good indicator for future outcomes. Overall, the training data correlates fairly well with match data, with the exception of the Juniores, which, as explained previously, do not always have optimal training conditions.

Author Contributions

Conceptualization: Catani A., Izzo R., Cruciani A.
 Methodology: Izzo R., Catani A., Crudelini E.
 Validation: Izzo R., Cejudo A., Hosseini C.
 Formal analysis: Cejudo A., Cruciani A.

Investigation: Cejudo, Catani A., Hosseini C.
 Data curation: Catani A., Izzo R., Cruciani A.
 Statistical analysis: Cejudo A., Crudelini E.
 Writing, original draft preparation: Izzo R., Catani A., Hosseini C.
 Writing, review and editing: Izzo R., Crudelini E.

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Disclosure statement

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