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Articles

The Correlation between the Emotional-Social Interaction of a Professor of Physical Education and Sports and his Students in the Physical Education and Sports Lesson

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Abstract

The aim of the study was to determine the correlation between the emotional-social interaction of a professor of physical education and sports and the activity of his students during the physical education and sports lesson, where the researchers used the descriptive approach, and the sample comprised (N = 14) teachers, and (398) students (aged 12 ± 14 years) from 14 Middle school of Mostaganem state, the researchers used The questionnaire form and the Weethol scale to measure the social-emotional interaction; they used the SPSS program in the statistical analysis of the data got we considered the results of statistical tests significant with $p < 0.05$; the results showed the existence of a positive and strong correlation between the first three behavioral groups of the tool, and the extent of student activity and the researchers recommend using indirect methods by professors in teaching, whether verbal or kinesthetic. The results of the sample showed that the arithmetic mean was (02.30 ± 88.30), and the standard deviation ranges within limits of (01.10 ± 20.40), the calculated value of (R) was (-0.97 ± 0.94), It is greater than the table ($R = 0.55$, $df = 13$, $p < 0.05$) and it is at the level of significance. We conclude that there is a significant correlation between the first three behavioral categories of Weethol's tool and the extent of students' activation and that there is an inverse relationship between the last three categories of behavior and the extent of students' activation.

Keywords: social emotional interaction, professor of physical education and sports, student activity, the physical education and sports lesson.

1. Introduction

The teaching process consists of a group of important components or elements, namely the teacher and the student, the educational objectives, the skill or the content of the lesson, the tools and equipment used, the methods, methods and teaching strategies, the professor's interactions and social interactions with the pupils, the procedures and steps followed in organizing the lesson, classroom management, evaluation and all of these The components need a teacher with a sufficient degree of experience to deal with them and in a way that achieves the desired goals. (Hayek, Sadiq Khaled, 2018: 57).

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The component of the professor's socio-emotional interactions with students is among the most important components of the teaching process, and it is the critical element that if the teacher mastered it, he helped him achieve The greatest amount of motivation for pupils and their revitalization of the teaching process and the participation of pupils in the output of the lesson.

Through the above, we wanted from our research this link between pupils' activity during their exercise of the lesson of physical education and sports and the social emotional interaction of the professor who is distinguished by means of adaptation, cooperation, communication, communication, etc. (Othman, 2013; Ahmed et al., 2010; Abdel hadi, 2004; Doraj, 2012).

The physical education and sports lesson is considered one of the forms of academic subjects, such as natural sciences, physics, and literature, as they meet in methods and objectives, and their curricula and content differ, but they fall into one point, which is to provide students with knowledge and direct them to a healthy future. The presentation of the physical education and sports lesson differs from these subjects in He does not care about the cognitive and scientific fields, but goes beyond that to the physical, psychological, social and health fields through activities (Harbach et al.,. 2020). In this regard, Muhammad Abu Odeh says, "Physical education and sports do not aim to form the individual from the physical point of view only, but rather its purpose is higher than that, it is the formation of the individual. Balanced in all its physical, moral, mental, social and psychological aspects, in addition to what the individual acquires in terms of health-related information in terms of hygiene and healthy behavior, as the general information of the individual increases through his contact and mixing with different external societies and interacting with them socially and culturally (Abu Odeh, 2009), which confirms that physical education And sports are not less important than the rest of the subjects, given their necessity in developing important aspects of the student's personality, especially from the social aspect. Which brings the student to adaptation and integration within the class, meaning the strengthening of relationships between students and the decoupling of isolation from each other, thus promoting proper adaptation?

The success of the physical education and sports lesson is limited to the role of the professor in presenting the various aspects of physical and sports activities, but he has a greater role than that, as he works to provide educational duties through physical activities that aim to develop and shape the values and high morals of students, taking into account the tendencies and desires of students (Khatibeyah, 1992) where both Ahmed El-Amin and Gargour indicate that there is a correlational relationship in a positive direction between each feature of the teacher's calmness and the motivation of perseverance among students and the existence of a correlational relationship in a positive direction between the social characteristic of the professor and the motivation of achievement behavior among students (Wadah, 2014) and Mukhtari and Yusef concluded that: "Social relations have a great impact on learning among adolescents in the study of physical education and sports and relying on group formation helps a lot in science and raising the level of students" (Mokhtari, 2018) in contrast to the study of Boughalia and Ahmad, so we find that there is a weak correlation between the competencies of a professor of physical education and sports and the dimensions of the following trend scale: social experience, health experience, stress reduction and athletic excellence (Boughalia, 2020).

Therefore, we were challenged by a problem: Does the emotional social interaction of a professor of physical education and sports have a role in motivating and stimulating students to practice physical and sports activities?

2. Methods

Research methodology: The researchers used the descriptive method to study the correlation between the emotional interaction of a professor and the activity of the students.

Research and Sample: The study population consisted of teachers and students of Mostaganem state schools.

The study sample comprises 398 students aged (12-14 years), fourth Middle year level, and 14 physical education and sports teachers for the 2019-2020 academic year, was randomly selected from the community of origin in the order of the table below:

Table 1. The distribution of the research sample (teachers and students) by some middle schools

Municipal	Name of the educational institution	Professor's name	Number of pupils
Sidi Cheikh	Zidouri Abdel kader Intermediate School	Khalil	30
Arboit	Karkab abdelmalek intermediate school	Benyoucef	29
Bouktab	Shirfawi Mohamed Intermediate School	Mbrek	28
Echkik	Madani mamar intermediate school	Fechfouch	29
Elkaf	Belakid mohamed intermediate school	Djeffel houari	27
Elghasoul	Abdali mohamed intermediate school	Boucek elhadj	31
Echalala	Hamitou elbachir intermediate school	Slimani	27
Elkhaither	Eldjadida elkhaither intermediate school	Farji	25
Tesmouline	Mahari kouider intermediate school	Talbi tahar	30
El Bayadh	Tajdin abdelkader intermediate school	Zair mourad	29
Sidi amer	Lkhadari mohamed intermediate school	Laribi amer	26
Bousamgho	Tarek ben ziad intermediate school	Rajaa salem	31
Ain elirak	Youcefi mohamed elwassini intermediate school	Bachiri	27
Brizina	Boukhabza elbay intermediate school	Koiadri salem	29
total summation		14	398

Materials

- The human field: represented by teachers and students of some of Mostaganem state schools.
- The pilot survey from 08/11/2020 to 18/11/2020.
- The basic experiment was conducted from 10/12/2020 to 30/12/2020.
- Filming was done for the exploratory experience in Mostaganem state schools.

Data collection tools:

First: Foreign sources and references.

Second: Cameras to film the teaching sessions, then take a sequence of 30-minute of each session.

- The main experience: The cinematography of the teaching sessions of physical education and sport (14 sessions) was carried out in the stadiums and the rooms of the educational establishments of the state of Mostaganem.

- Preparing the form and explaining the measuring tools:

To build the questionnaire (related to student activity), we consulted with some teachers, and phrases we are extracted on teacher motivation for students, then conducting an exploratory study to survey and knowing the extent of the validity of the form (the student form) and judging it by the teachers so we used in analyzing the results and unpacking them the five-point scale of the Likert which is:

- The first axis: the psychological role (includes 12 phrases)
- The second axis: an educational and social role (includes 12 phrases)
- Method of evaluating the scale scores. Drafting the scale paragraphs with a positive form and they base the evaluation of the answer on a five-year scale. Graduation (practiced to a very large degree, we give it "5" degrees, it are practiced to a large extent "4", it are practiced with a medium degree "3" it are practiced weekly "2", it are practiced very weakly we give it "1" degrees.

Through this, we have reached a review of this form and its correction by the professors. The phrases for the subject of our study (for the form and the tool) we are extracted. And after viewing it a group of experts in pedagogy the final version of the form intended for middle school students has been reached.

Weethol tool to measure social-emotional interaction.

How to observe and record with the Weethol tool in observing the social-emotional interaction of the professor:

The Weethol tool is used to observe the professor in places of study during his teaching of any systematic topic. Where the Weethol tool for observing the social-emotional interaction of the class members comprises seven behavioral categories: the first three are reinforcing for the pupils and their behavior (reinforcing behavior for the pupils, the behavior of accepting and clarifying what the students show, the behavior that helps the students to solve) and the fourth is impartial (Impartial behavior), and the last three are reinforcing For the teacher and for the behavior and roles he performs in classroom education (behavior directed at students, the behavior of rebuke, reprimand, reprimand and condemnation, the behavior of strengthening the teacher for himself) and when observing the teaching with a tool, the observer intends to sit in an area of the classroom that enables him to see what is happening in the place of study and hear what the professor is showing And students of phrases, comments, inquiries, directions, instructions, and questions. The best classroom site that enables him to do all this, seeing and hearing the course of the class without interfering or negatively affecting it, is one of the back corners of the class. The observer takes a Weethol model with him to record what happens from the seven teachers' behavior. It is preferable for the observer to attend the class at the beginning of the class, where he spends the first minutes in identifying the general components of the class and the method of organizing them, and also distinguishes the occasion or the behavioral beginning that the teacher or students initiate in the first session and usually directs the nature of events, methods of interaction and its content in the following minutes or during the whole session Sometimes the observer can, in order to facilitate the recording and the multiplicity of types of behavior, divide the session into periods of ten or fifteen minutes each, where he places a sign, Next to the type of behavior that he notices each time it occurs. The observer uses the following procedural principles to observe and distinguish the seven behavioral types that are embodied in the present Weethol tool: We summarize them in the classification of any statement, comment, question, or reference that focuses on the teacher or the student and aims in the appropriate field for it (Hamdan, 1999: 100).

Research variables:

- The independent variable: the social emotional interaction of teachers of physical education.
- Dependent variable: the extent of pupils' activity.

How to work in the basic study (procedures):

After the exploratory study, we started our basic study where one researcher tends to the intermediate level and then takes a suitable place to register with a tool for emotional-social interaction, as we mentioned above, then after the class, we distribute the form to 30 students for

each pupil's share of direct registration classes and give a chance of (10 to 12mn) at most. To retrieve the form, the researcher answering students 'questions for some vague phrases (the form directed to them). Then we calculate the average total of (10mn) classes for each of the phrases of the Weethol tool and the average of the total of the students 'answers to the questionnaire, then calculate the correlational relationship between the emotional-social interaction and the extent to which the teacher motivated students to perform the physical education and sports class well.

The exploratory study

The exploratory experiment was conducted by the method of conducting the test and returning it in two phases, where the time difference was a week, so the researchers reached the following results: The validity coefficient ranged by using Pearson's coefficient of the questionnaire directed to the pupils of the two axes, the lowest correlation coefficient was 0,882 and the highest value 0,938 and this shows That the tool (the questionnaire directed to students) is characterized by high validity and reliability coefficient

The researchers used the stability factor, and its value ranged respectively: 0.939 and 0.968), which shows that the tool is characterized by high stability. As for objectivity, the two tools, after being presented to the aforementioned arbitrators, agreed that the tool actually used measures what it should measure, as the following table shows the validity and reliability of the students 'questionnaire: where the exploratory sample was represented by students of some averages from the white state of (07) students without the study sample The original and very similar to the original sample to ensure the validity of the measuring instrument.

Table 2. The results of the Pearson correlation coefficient to calculate the validity and reliability of the measuring instrument

Behaviors (talk of learning and pupils)	Sample volume	Computed correlation coefficient	Honesty Lab
The first axis	07	0,82	0,90
The second axis		0,98	0,99
The tabular value of (t) is at the significance level 0,05 and below the sine degree 06 = 0,81			

Through Table 2 it is evident that the validity coefficient of the axes that make up the measuring tool (the students 'questionnaire) reached the lowest correlation coefficient (0,82) and the highest value (0,98). This shows that the tool is characterized by a high degree of honesty, and the researchers used the reliability coefficient. Self, where its lowest value ranged from (0,90) and its highest value (0,99). This indicates that the tool is characterized by a high degree of honesty and stability.

Statistical Analysis:

- Arithmetic means and standard deviations;
- Percentages;
- Pearson correlation coefficient;
- Reliability factor square root of the truth factor.

3. Results and discussion

The link between the emotional interaction of the teachers and his encouragement for the students.

Table 3. The arithmetic averages, standard deviations and percentages of the results of unloading the tool of weethol (emotional interaction) and the form of teacher encouragement for students and the correlation between them.

Relationship type	Statistical significance	The computed value (t)	Standard deviation	SMA	The axes of the student motivation form	Percentages	Standard deviation	SMA	Thule's phrases of behavior
positive	Function	0,94	4,62	48,59	The first axis	18,3 %	11,5	54,4	Reinforced behavior of pupils
positive	Function	0,92	4,99	48,20	The second axis				
positive	Function	0,98	4,62	48,59	The first axis	29,7 %	20,4	88,3	Acceptance behavior and clarification
positive	Function	0,97	4,99	48,20	The second axis				
positive	Function	0,96	4,62	48,59	The first axis	18,7 %	11,5	55,6	Assistant to solve problems
positive	Function	0,98	4,99	48,20	The second axis				
positive	Not function	0,05	4,62	48,59	The first axis	1,7 %	1,1	5,0	Impartial behavior
positive	Not function	0,11	4,99	48,20	The second axis				
positive	Not function	0,24	4,62	48,59	The first axis	24,5 %	7,5	72,7	Pupil-directed behavior
positive	Not function	0,34	4,99	48,20	The second axis				
Negative	Not function	-0,59	4,62	48,59	The first axis	0,8 %	1,2	2,3	Behavior, reprimand and forgiveness
Negative	Not function	-0,62	4,99	48,20	The second axis				
Negative	Not function	-0,97	4,62	48,59	The second axis	6,3 %	6,3	18,9	Self-reinforcing behavior of the professor
Negative	Not function	-0,97	4,99	48,20	The third axis				
Tabular value (t) at the level of significance 0,05, degree of freedom 13 = 0,55, sum of averages = 297, and deviation = 31,4									

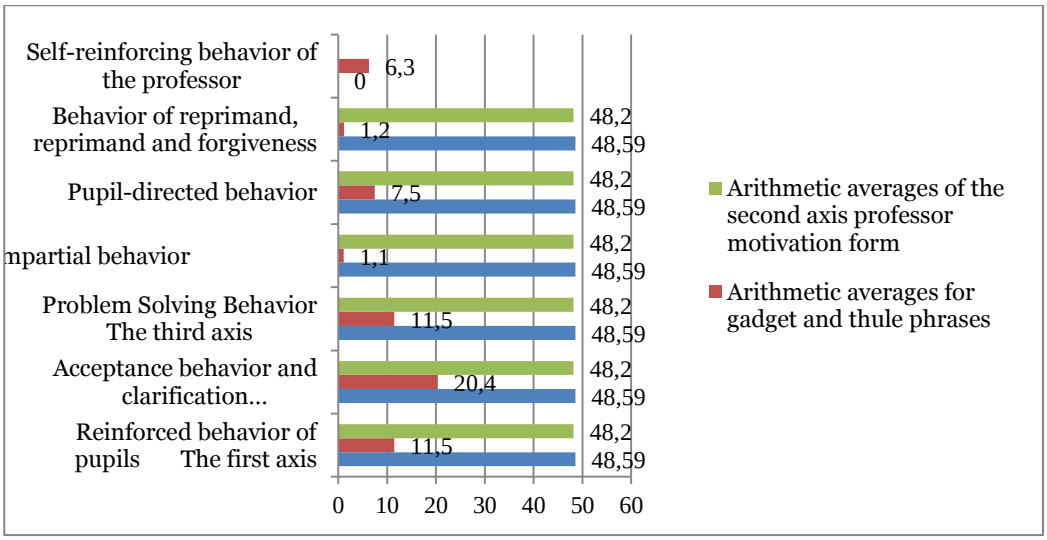

Fig. 1. The arithmetic averages for the phrases Weethol tool (the emotional interaction of the professor) and the arithmetic averages for the phrase, a comment, a question, or a reference that focuses on the professor or the student to encourage the teacher to his students.

We realize from Table 3 and Chart (01) that the calculated value of "R" is greater than the tabular "R" (0.55) in the classes or types of social-emotional interactions of the indirect professor

(reinforcing behavior of students – the behavior of acceptance and clarification – supportive behavior). On problem-solving (with two axes, the student's motivation form, which is evidence of a strong positive correlation between the type of indirect social-emotional climate that prevailed in the class atmosphere and the interaction of the teacher to encourage students and increase student activity in class. No. (3.2.1) the reinforcing behavior of pupils – acceptance behavior and Explanation – Helping behavior to solve problems) where the percentage of professor's behavior and interaction reached 18.3 % 29.7 % 18.7 respectively in category No. 3.2.1. It can be said according to the "Weethol" tool that the professor was indirect in his interaction and building on his emotional-social interaction with the students, and thus this leads to stimulating pupils' activity during the class. As for the other groups, the calculated "t" was less than the tabular but the relation in the two categories, 7.6, where the teacher's interaction and interaction rate was in the 7.6.5 category (behavior directed at pupils – rebuking and reprimanding behavior - self-reinforcing behavior of the teacher) 24.4 %, 0.8,6.3 %, respectively, so here the teacher is direct in his dealings with students and is constructive In his social-emotional interaction, and thus the return on pupils' activity is in a rapid and noticeable decline, as the percentage "R" calculated for the last three categories of the tool of weethol was less than the tabular and negative evidence of the existence of an inverse relationship between the direct categories of tool and thaw and stimulating student activity.

The first hypothesis, in which we assume that there is a positive correlation between the three direct categories of a tool, a tool, and the extent to which the teacher encourages and motivates students to perform physical activity. To prove this hypothesis, it is shown to us through Table 4, and this result we have reached is consistent with the findings of previous studies, Clear Al-Amin, Muhammad George, and Saibi Yusef, where they came out with the conclusion that (there is a strong positive correlation between some characteristics of the professor's personality and the motivation of achievement among pupils towards the class of physical education and sports. Social relations have a great impact on learning among adolescents in the study of physical education and sports and relying on forming groups helps a lot in Knowledge and raising the level of pupils) and the researchers attribute this result to the fact that the teachers were indirect in their teaching and it becomes a work The professor is easy and effective, and Sarhan asserts, "The teachers' work becomes easier and more productive if the students are driven to self-learning and thus more attainable (Sarhan, 2015). Hall and others add, "It is the tendency to feel and act as if the individual is an influential factor in life events and not a helpless person. And weak ". Indirect methods of teaching are effective in stimulating students to take part in the work (Hull et al., 1987).

Regarding the second hypothesis, in which we assume that there is a negative relationship between the last three direct categories of the tool of weethol (behavior directed to students, the behavior of reprimand and reprimand and forgiveness, the behavior of strengthening the teacher for himself) and the extent to which the teacher encourages and motivates students to perform physical activity and to prove this hypothesis, it is shown to us through the three boxes The last of Table 4 and this result is in line with the findings of previous studies. It is clear to the Secretary where he came out with a result (that there is a negative relationship between the trait of aggression of the professor and the motivation of the level of ambition of third-stage secondary education pupils and a correlational relationship toward Positive between the calm character of the professor's personality and the motivation of perseverance among the students in the third year of high school) and the researchers attribute this result in that the more direct teachers they are in their teaching, the greater the behavior of rebuking, reprimanding and asking for forgiveness for the professor and the behavior of the professor's reinforcement of himself on his students and that is because of the large number of behavior directed to students, as teaching strategies can To talk to students and create motivation for them to learn this subject (Abu Salma, 1995, p. 24) and the professor here is less intrusive. It is only directed, and the professor's speech is little, which contradicts the concept of "the student at the center of the educational process" (Marwan, 2016) (The National Curriculum Committee, March 2015). Consequently, direct methods in teaching are ineffective to stimulate students to participate in work and thus not achieving teaching with competencies. Like what has stipulated in the second generation curricula Algeria and the goals remain mere rhetorical statements and slogans that rise above reality and distract from its concerns (Boussouar, 2016). Finally, we recommend the use of indirect methods by professors in teaching, whether verbal or kinesthetic - giving a large space when teachers form emotional-social interactions

during Teaching – Holding training sessions for professors in various teaching stages and emphasizing the importance of social studies.

4. Conclusion

Through the results of the hypothesis, we conclude that the relationship is correlative between the behavioral groups: the first three of the tool of weethol and the extent of pupils' activity, which is consistent with the study of Clear Al-Amin and Saibi's study that "the relationship between the social trait of the professor and the motivation of achievement behavior among students is positively high" (Wadah et al., 2014; Mokhtari, Bensaibi, 2018), where previous studies, and our study, recommend attention to the psychological and social aspect of the education stage for pupils to move away from complete control and roughness in the treatment of students and try to approach them in solving their problems, which is what Zamali shows that the use of teaching with competencies, i.e. indirect methods in teaching, strengthens Some psychological skills such as self-confidence (Zamali, 2013). As for the inverse relationship between the behavioral groups: the last three and the extent of student activity, we find that they are consistent with the study of Boghalia and Ahmad. There is a weak correlation between the competencies of the professor of physical education and sports and the dimensions of the scale of the following trend: social experience, health experience, stress reduction, and athletic excellence (Boughalia, 2020), meaning that the study sample was direct in its work and did not consider social relations in the teaching of This requires us to prepare curricula that satisfy the emotional-social relations and to work with them with the establishment of training courses for teachers and to emphasize in them the importance of the professor's personality and his social interactions with students according to our curriculum.

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Knowledge, Attitudes and Practices Related to Doping among Cameroonian University-Level Athletes: A Cross-Sectional Study

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Abstract

The need to maintain or improve physical performance often prompts athletes to resort to doping. The objective of this work is to assess the knowledge, attitudes and practices in doping of Cameroonian university-level athletes. One hundred and thirty-eight university-level athletes (100 male and 38 female) answered a self-administered questionnaire, providing information on their knowledge, attitudes and practices towards doping. The results show that 96.4 % of athletes have knowledge about doping, 88.4 % know about doping substances, 96.3 % have a positive attitude towards doping and 90.6 % have never used doping products. In addition, it had already been proposed to use doping products at only 33.3 % and these proposals came from teammates (27.1%), friends (24.6 %) and the coach (12.9 %). Regression analysis reveals that the risk of doping is 27 times (OR = 27.10; p = .00027) higher among respondents over the age of 30. This risk is 5 times (OR = 5.10; p = .0486) higher in athletes who have had proposals for doping substances, and 25 times (OR = 25.15; p = .0170) higher among respondents who indicated their intention to dope. Cameroonian university-level athletes have high knowledge about doping, however, a positive attitude towards doping and the practice of doping remains low. There is a need to improve doping education in order to increase knowledge on doping issue, and to establish appropriate doping control structures and policies.

Keywords: doping knowledge, doping attitude, doping practice, university athlete, Cameroon.

1. Introduction

Nowadays, the practice of high level sport requires a lot of preparation because of the frequency of the competitions, their intensity and the high financial stakes. This situation predisposes athletes to many traumas due to stress or homeostatic disturbances induced by the regularity of training sessions and competitions (Kreher, Schwartz, 2012). Therefore, recovery phases of satisfactory duration and quality are necessary in order to maintain an optimal balance and a good level of sports performance. A lacking of good recovery will lead to overload, thus can train the athlete to a state of fatigue or overwork, which will in turn lead to a decrease of performance. Due to the pressures that athletes face, exerted by their employer, supporters and close social circle, the need to maintain or improve their physical performance is increasingly felt

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(Boit et al., 2015; Government of Kenya, 2014). To do this, some athletes sometimes look for more or less illegal strategies, such as doping.

The aim of doping is to improve the functional and mental capacities of the individual through the use of prohibited substances and methods in order to maintain or increase the level of physical performance and consequently the chances of victory (International Olympic Committee [IOC], 1998; World Antidoping Code, 2009).

Doping is a serious health-threatening behavior with numerous negative consequences for athletes' health status (Honour, 2016; Mazanov et al., 2012; Kondric et al., 2011; Ljungqvist, 2014), that can lead to several deaths in athletes (Hausmann et al., 1998). According to the World Antidoping Agency [WADA] (2013), the number of sample abnormal analysis results recorded by anti-doping authorities around the world has increased by more than 20 % since 2012. This percentage could be higher if systematic doping control were carried out with athletes, especially at the African level. However, the costs of carrying out these doping controls are high, especially for national anti-doping organizations like those of the majority of African countries.

Thus, from a research perspective, the studies have focused on evaluating the knowledge, attitudes and practices of doping among athletes, with the aim of establishing policies aimed at reducing the possibilities or doping intentions among the athletes concerned. Indeed, it is a question of warning athletes of the dangers to which they are exposed, in the short, medium and long term, because of the use of doping substances or methods. These studies have been carried out at the global, African and national levels.

At the global level, studies first focused on the validation of tools likely to assess the knowledge, attitudes and practices of athletes with regard to doping (Petroczi, Aidman, 2009; Brand et al., 2014 ; Malek et al., 2014; Rintaugu, Mwangui, 2021). Then, evaluation studies of these variables were carried out in various countries (Morente-Sanchez et al., 2019; Campian et al., 2018; Domagala-Rodacka et al., 2018; Al Ghobain et al., 2016; Sekulic et al., 2016). In addition, research aimed on the one hand at determining the prevalence of doping in sports (Al Ghobain et al., 2016; Sekulic et al., 2016), and at identifying predictive factors of doping on the other hand (Devcic et al., 2018; Bae et al., 2017; Blank et al., 2016a; Blank et al., 2016b; Sekulic et al., 2016) were performed.

At the African level, we record very little research in the field. However, a study carried out in Uganda established the attitudes, knowledge and practices of doping in a sample of Ugandan professional athletes in 4 contact sports (basketball, football, handball, rugby) and in 2 individual sports (athletics, cycling) (Muwongue et al., 2015). Similarly in Kenya, studies whose objectives were to assess the knowledge, attitudes and practice of doping among elite middle and long distance runners (Chebet, 2014) and to examine the knowledge, attitudes and and perceptions on doping among university students attending sports-related courses (Rintaugu, Mwangui, 2021) were realized.

In Cameroon, few studies also exist, only, we can quote those by Ama et al. (2003) who insvetigated the use and awareness of lawful and unlawful substances by amateur footballers in Yaounde and, Ama et al. (2002) who examined attitudes and knowledge about doping among pharmacists in the city of Yaounde in Cameroon.

As doping in sports is a problem that affects both elite and university athletes (Chebet, 2014), to our knowledge, there is no study carried out in Cameroon on this target, however university-level athletes constitute a breeding group in which elite sport draws its new talents. The objective of this research is to assess the knowledge, attitudes and practices related to doping of Cameroonian university-level athletes.

2. Methods

Researh design and study participants

A descriptive cross-sectional research design was used to identify the doping knowledge, practices, and attitudes of Camroonian university-level athletes, during the period of May to June 2020, in the University of Yaounde I, Cameroon. The study was approved by the Deputy Director of the National Institute of Youth and Sports of Yaounde, Cameroon. A total of 138 university athletes (27.5 % female and 72.5 % male) regularly attending the national championship in their respective sports disciplines were enrolled in the study. The selection criteria targeted students who were athletes over 18 years of age and currently competing at the national level. Participants who did not competed in the past year were excluded. According to the sport discipline, since the number of

athletes was high in football (47 athletes, 29.1 %) and handball (33 athletes, 20.5 %), we encompassed all the other athletes in one group. Regarding the age item, participants were divided into 4 categories (< 21 yrs; [21 – 25[; [25 – 30[; and, > 30 yrs). The average age of the sample was 26 ± 4 yrs. The sample size was calculated using Raosoft calculator with 95 % confidence level, a maximum error of 5 % and with a response distribution of 50 % (recommended). All the participants gave their informed consent to participate in this study. Table 1 shows the participants' characteristics.

Table 1. Sociodémographic characteristics

Gender (N = 138)		
Female	38	27.5 %
Male	100	72.5 %
Mean age (years)	26 ± 4	
< 21	19	13.8 %
[21 - 25[	30	21.7 %
[25 - 30[	57	41.3 %
> 30	32	23.2 %
Sport discipline		
Football	47	29.1 %
Handball	33	20.5 %
Others	58	50.4 %

Instrument and data-collection procedure

After a literature review, a questionnaire was self-constructed by the authors. The questionnaire intended to investigate the participants' knowledge, attitude and practice towards doping of Cameroonian university athletes. The questionnaire was reviewed and validated by an expert panel with the participation of university professors and the members of the Cameroonian Andi-doping Organization not involved in the project. It was then pilot tested to ensure and determine clarity and the panel of expert approved the final version of the questionnaire. This questionnaire was made of 4 sections. Section one sought the demographic details of the respondents (age, gender, sports participation). Section two of the questionnaire concerned knowledge of the respondents on doping. Section three sought information on attitudes of the respondents towards doping. This part of the questionnaire was adapted from the Performance Enhancement Attitude Scale (PEAS). Acceptable reliability indices of the scale have been reported in previous studies involving college and elite athletes (Moran et al., 2008; Petroczi, Aidman, 2009). Section 4 refered to doping practice and collected informations such as doping use and submission to anti-doping control. The data were collected by administering the questionnaire on different days from May to June 2020, at the training grounds of each discipline before or after training sessions. Instructions on how to complete the questionnaire properly were given before it was handed out. Athletes were informed that the data they provided would be used for academic purposes. Filling out the questionnaire was totally voluntary. Athletes were guaranteed complete anonymity, and written informed consent was obtained from each athlete before participating in the study.

Data analysis

Demographic variables were reported using descriptive statistics. Continuous variable were reported in terms of means and standard deviations and categorical variables were reported in terms of frequency distributions. As questions were single or multiple choice options, the proportions do not add up to 100 % for the questions with multiple responses. Multivariate logistic regression was used to identify factors associated with the doping behavior. The outcome

variable was the use of doping and the independent variables (factors) included gender, age, participation in competition, heard about sport doping, proposal of doping substances, knowledge of doping substances, submission to anti-doping control, intention to dope in the future, and sports discipline practiced. Odd ratios (brut and adjusted) along with their confidence interval at 95 % (95 % CI) and level of significance were computed. A log-transformed value of likelihood was used to appraise the goodness-of-fit of each logistic regression model. All analysis were performed using IBM© SPSS© Statistics version 20 (IBM© Corp., Armonk, NY, USA). A p-value of < 0.05 was considered statistically significant.

3. Results

Table 1 shows the socio-demographic characteristics of participants. Almost ¾ of the participants (72.5 %) are male. Thirteen point two percent of them are less than 21 years old, 63.0 % are between 21 and 30 years old, and 23.2 % are over 30 years old. The most represented sport discipline is football (29.1 %), then handball (20.5 %).

Among the participants, 50.0 % of them were elite athletes (Table 2). Of them, 24.7 % belonged to the international level, 33.3 % to the national level, and 7.2 % to the regional level. Furthermore, 74.6 % participate to competition and the majority trained for more than 1 hours per session.

Table 2. Sport participation

Variables	N	%
Elite athlete[a]		
No	69	50.0
Yes	69	50.0
Which one ?		
International	17	24.7
National	23	33.3
Regional	5	7.2
Not declared	24	34.8
Participation to competition[b]		
No	35	25.4
Yes	103	74.6
Duration of sport training session (hours)		
< 1	5	3.6
[1–2[	112	81.2
> 2	21	15.2

[a] Are you member of the sport elite?
[b] Do you take part in the championship?

With respect to the general knowledge about doping (Table 3), 96.4 % of the respondents declared that they have already heard of doping and 88.4 % know about doping substances. The main source of information is the media (37.5 %), followed by friends (24.6 %), colleagues

(17.9 %), studies (9.8 %), coach (8.0 %), and the parents (1.8 %). But, 72.7 % of them can not cite doping substances. In the 27.3 % remaining, the frequent substances cited were cocaine (9.1 %), guronsan (7.6 %), anabolic steroids (6.1 %), Indian hemp (4.5 %), energy drinks (3.8 %), and diuretics (0.8 %).

Table 3. General knowledge about doping

Variables	N	%
Received information[a]		
No	5	3.6
Yes	133	96.4
Source of information		
Media	61	37.5
Friends	40	24.6
Colleagues	29	17.9
Coach	13	8.0
Parents	3	1.8
Studies	16	9.8
Do you know about doping substances ?		
No	16	11.6
Yes	122	88.4
Known substances[b]		
Anabolic steroids	8	6.1
Guronsan	10	7.6
Cocaine	12	9.1
Energy drinks	5	3.8
Diuretics	1	0.8
Indian hemp	6	4.5
Don't know	96	72.7

[a] Have you ever heard of doping ?
[b] Cite some substances you know

Concerning doping attitudes (Table 4), the main reason for doping declared is to improve performance (76.8 %). For 2.9 % of the participants, doping increases agressivity and self-confidence/courage for 10.9 %. When asked whether they think it is likely or unlikely that over the next year they will use doping products to improve their athletic performance, participants replied extremely unlikely (22.5 %), very unlikely (10.9 %), quite unlikely (27.5 %), very probable (4.4 %), while 34.8 % have no idea. Ninety six point three percent of the participants do not plan to dope, even if more than ¾ of them (72.8 %) will not feel bad if they were using doping substances. On a scale ranging from 0 to 100 %, 72.7 % of the Cameroonian university athletes admitted that there is no chance for them to use doping substances to improve athletic performance. From 1 to 50 % of chance, there are 23.5 % of the participants who can use doping substances and, from 51 to 100 %, there is only 3.8 %.

Table 4. Doping attitude

Variables	N	%
Doping reasons		
Improve performnace	106	76.8
Increase agressivity	4	2.9
To have self-confidence/courage	15	10.9
Don't know	23	16.7
Probability to use doping products [a]		
Extremely unlikely	31	22.5
Very unlikely	15	10.9
Quite unlikely	38	27.5
Very probable	6	4.4
No idea	48	34.8
Do you plan to dope?		
No	132	96.3
Yes	6	3.7
Would you feel bad if you were using doping substances?		
No	118	72.8
Yes	44	27.2
Chances to use doping substances [b]		
0 %	118	72.7
1-10 %	19	11.7
11-20 %	4	2.5
21-30 %	7	4.3
31-40 %	4	2.5
41-50 %	4	2.5
51-60 %	3	1.9
61-70 %	3	1.9
71-80 %	0	0
81-90 %	0	0
91-100 %	0	0

[a] Do you think it is likely or unlikely that over the next year they will use doping products to improve your athletic performance?
[b] In the next year, what are the chances in 100 that you will use doping products to improve your athletic performance?

Regarding doping practice (Table 5), 90.6 % of the participants declared that they have not yet been offered doping substances/methods, and for 66.7 % of them, anyone never advised them to use doping substances. For the 33.3 % remaining, advises reported to have come from coach (12.9 %), friends (24.6 %), colleagues (27.1 %), parents (3.7 %), and someone in the sport center (14.8 %). More than ¾ of the participants (75.4 %) have never undergone doping control.

Table 5. Doping practice

Variables	N	%
Have you been offered doping substances/methods?		
No	125	**90.6**
Yes	13	**9.4**
Has anyone ever advised you to use doping substances?		
No	92	**66.7**
Yes	46	**33.3**
Source of advise		
Coach	21	**12.9**
Friends	40	**24.6**
Colleagues	44	**27.1**
Parents	6	**3.7**
Someone in your sports center	24	**14.8**
Nobody	27	**16.6**
Have you ever undergone an anti-doping control?		
No	104	**75.4**
Yes	33	**24.6**

The associate factors with doping use are reported in Table 6. The results revealed that the risk of doping is 27 times (OR = 27.10; p = 0.00027) higher in respondents aged over 30 compared to those under 21. This risk is 5 times (OR = 5.10; p = 0.0486) higher in athletes who have had proposals for doping substances compared to those who have not had proposals, and 25 times (OR = 25.15; p = 0.0170) higher among respondents who indicated their intention to dope compared to those who did not intend to dope.

Table 6. Risk factors with doping use

Factors		N	N (%)	OR[a] (95% IC)	p-value	OR[b] (95% IC)	p-value
Gender	Female	**38**	2 (5.3 %)	1		1	
	Male	**100**	10 (10.0 %)	2.00 (.42 - 9.58)	.3858	1.23 (.17 - 8.67)	0.8354
	< 21	**19**	1 (5.3 %)	1		1	

Age (years)	[21 - 25[	**30**	4 (13.3 %)	2.77 (.29 - 26.87)	.1483	68.94 (.22 - 21464.31)	0.1483
	[25 - 30[	**57**	5 (8.8 %)	1.73 (.19 - 15.83)	.1679	52.28 (.19 - 14488.85)	0.1679
	> 30	**32**	2 (6.3 %)	**1.20 (1.01 - 14.20)**	**.0088**	**27.10 (1.07 - 9839.82)**	**0.0027**
Participation in competition	No	**40**	2 (5.0 %)	1		1	
	Yes	**98**	10 (10.2 %)	2.16 (.45 - 10.33)	.3351	2.00 (.28 - 14.27)	0.4874
Heard about sports doping	No	**5**	1 (20.0 %)	1		1	
	Yes	**133**	11 (8.3 %)	0.36 (.04 - 3.52)	.3799	0.22 (1.08E-3 - 43.43)	0.5716
Proposal of doping substances	No	**94**	3 (3.2 %)	1		1	
	Yes	**44**	9 (20.5 %)	**7.80 (1.99 - 30.50)**	**.0032**	**5.10 (1.01 - 25.78)**	**0.0486**
Knowledge of doping substances	No	**30**	2 (6.7 %)	1		1	
	Yes	**108**	10 (9.3 %)	1.43 (.30 - 6.90)	.6572	1.41 (.16 - 12.24)	0.7565
Submission to anti-doping control	No	**104**	7 (6.7 %)	1		1	
	Yes	**34**	5 (15.2 %)	2.47 (.72 - 8.40)	.1463	2.94 (.49 - 17.85)	0.2403
Do you plan to dope in the future ?	No	**132**	9 (6.8 %)	1		1	
	Yes	**6**	3 (50.0 %)	**13.67 (2.40 - 77.69)**	**.0032**	**25.15 (1.78 - 355.38)**	**0.0170**
	Others	**58**	3 (5.2 %)	1		1	
Sport discipline	Handball	**33**	2 (6.1 %)	1.18 (.19 - 7.47)	.1058	0.71 (.06 - 7.74)	0.7759
	Football	**47**	7 (14.9 %)	3.21 (.78 - 13.18)	.8583	5.55 (.80 - 38.31)	0.0823

OR = Odds ratio ; IC = Confidence interval
a = brut OR; b = ajusted OR

4. Discussion

The present study was carried out to assess the knowledge, attitudes and practices of Cameroonian university-level athletes towards doping. At the end of it, we noted that university level athletes have a high knowledge of doping, they do not intend to dope in the future and almost ¾ claim that they would not feel not bad if they used doping substances. However, the use of doping substances and methods in academia by athletes remains low. In addition, age, proposals for doping and the intention to dope are the risk factors for doping among university athletes.

Regarding knowledge about doping, the present study revealed that 96.4 % of the athletes surveyed had information about substances and substances and methods banned in sport. This high percentage could be justified by the fact that the people surveyed are university-level sportsmen and therefore have a level of understanding allowing them to better understand the effects of doping. These results suggest that an individual's state of knowledge about doping is influenced by their level of education (Muwongue et al., 2015). The results obtained in the present study reveal a higher percentage than those obtained in other previous studies which reported 93 % among professional Cameroonian athletes (Ama et al., 2003), and 84 % among elite Ugandan athletes (Muwongue et al., 2015). They are also higher than those of Erdman et al. (2007) who obtained a percentage of 76.7 % among Canadian athletes, and than those obtained by Waddington et al. (2010) among members of the English Professional Football Association. Other studies reported a much lower percentage than our study. This is the case with Chebet (2014) among Kenyan elite athletes (46.4 %), and Albrecht et al. (1992) in elite athletes in the United States (36 %).

During this work, more than 76.8 % of university sportsmen attribute the use of prohibited substances to improving performance, building self-confidence/courage (10.9 %) and increasing aggressivity (2.9 %). This reinforces the idea that resorting to doping increases and improves the performance of the athlete (WADA, 2009; 2015). These observations could have implications for

the implementation of a doping awareness program, through which academic institutions could serve as channels for disseminating anti-doping messages (Morente-Sanchez, Zabala, 2013).

The majority of athletes in this study revealed that the main sources of information on doping were colleagues (17.9 %), friends (24.6 %), coaches (8.0 %) and especially the media (37.5 %). This result is in agreement with that of Erdman et al. (2007), who noted that family, friends and teammates were the most common sources of information on the use of doping products and substances in a group of 582 high performance Canadian athletes. This observation is contrary to that of Somervile and Lewis (2012), who indicated that the team doctor was the most popular source of information on doping substances and methods in a survey on 196 British Olympic-level athletes. The present study found that teachers are another source of information about doping. Indeed, some participants in our study are students who have anti-doping items in their training program. Therefore, anti-doping programs designed to target this group of people could have a significant impact on the doping knowledge, attitudes and practices of athletes.

Although most of the athletes in the present study indicated a modest knowledge of anti-doping information, 83.7 % of them could correctly identify why to dope as stated by WADA (2015). This finding could be a limitation of existing anti-doping programs, which can be corrected by appropriate educational programs (Morente-Sanchez et al., 2019). In addition, it should be mentioned that insufficient media coverage of doping-related themes and lack of awareness about doping is a serious concern in Cameroonian sport and may explain the lack of knowledge on some aspects of doping observed among athletes in this study.

With regard to attitudes about doping in sport, since attitudes could be considered as predictors of doping behavior, we examined in this study factors associated with a risk of doping use. Our results revealed that the risk of doping is 27 times (OR = 27.10; p = 0.00027) higher in respondents aged over 30 compared to those under 21 years. These results are similar to a study in Kenya among elite athletes which indicated that athletes over the age of 30 said they were more likely to use performance enhancing drugs while those over 30 under the age of 30 had no intention of doping because they still felt strong and performing well (Chebet, 2014). Indeed, after 21 years, the more the age increases, the less we have high physical capacities and the more the performance decreases. In addition, the risk of doping is 25 times (OR = 25.15; p = 0.0170) higher among respondents who clearly indicated their intention to dope compared to those who did not intend to dope. This risk is 5 times higher (OR = 5.10; p = 0.0486) among respondents who had proposals for doping substances compared to those who had no proposals.

The results of the present study indicated a strong positive attitude towards doping, with 76.8 % of athletes indicating that doping products are necessary to increase and improve their performance. Our results are close to those of Scarpino et al. (2010) who indicated a strong positive attitude towards doping, with 60 % of athletes and coaches indicating that doping products are necessary to improve performance. These results contradict those of Chebet (2014) among Kenyan elite athletes, Alaranta et al. (2006) among elite athletes receiving financial support from the National Olympic Committee, Peretti-Watel (2005) among elite athletes, who found that more than 90 % of athletes consider doping to be dishonest, unhealthy and hazardous and who believe that it is possible to achieve the highest level of performance without doping.

Regarding the practice of doping in sport, the present study indicates a very low use of doping products, substances and methods (9.4 %) among university athletes. However, it is possible that the current prevalence is much higher than that obtained, as most athletes may not wish to be directly associated with its use (Otieno, Ofulla, 2007). These authors indicate that young people feel comfortable answering a question about the possibilities of using drugs rather than a question about actual drug use. Our results are close to those of Scarpino (1990), where 10 % of the study subjects admitted the use of different forms of doping substances and products. They are higher than those obtained by Muwongue and colleagues (2015) in Ugandan elite athletes, where 3.3 % reported use of doping substances and methods among relatively weak athletes. Our results are also higher than those of Wroble and colleagues (2008) among elite athletes where a low rate (1 %) of the prevalence of anabolic steroids was detected.

In this study, the majority of athletes have never been tested for doping (75.4 %). Knowing that there are only 63.6 % of participants who take part in competitions, this observation could be also due to the lack of anti-doping tests in the country or when athletes fear being falsely identified as being doped or as actually doped and fear being caught (Muwongue et al., 2015). It is therefore

important to note that athletes must be fully aware of and comply with any WADA anti-doping rule violations, as they also risk penalties.

5. Conclusion

Cameroonian university athletes have high knowledge about doping, potentially positive attitudes towards doping and low doping practice. Age, proposals for doping and intention to dope are predictors of doping in this population.

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Basketball Reserve Preparation: Problems and Prospects

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Abstract

The article considers the main aspects of the formation of sportsmanship of young basketball players. It is established that the program of long-term training of basketball players is focused on the demonstration of physical and technical training of basketball players, which is considered as a leading strategic direction of training young highly qualified athletes in modern conditions. The paper presents the results of research on the level of physical and technical fitness of young basketball players. According to the results of empirical research it is established that insufficient development of all physical qualities increases the duration of formation of special skills during mastering the technique of basketball and reduces the efficiency of their use in competitive wrestling. It was found that the training of young basketball players should be aimed at realizing the maximum opportunities for each athlete in the optimal period for the demonstration of sports results. The presented results can be used as a scientific basis for a purposeful choice of means and methods of training to improve the structure of comprehensive training of young basketball players.

Keywords: sports training, young basketball, physical fitness, qualities.

1. Introduction

The progress of high-achievement sports is associated with the substantiation of elements of the system of athletes and its focus on sports results (Csataljay et al., 2009; Köklü et al., 2011). Training high-class basketball players is a complex, dynamic pedagogical process based on a deep understanding of the causes of the factors that determine its effectiveness under the direct influence of the changes taking place in basketball (Erculj et al., 2009; Köklü et al., 2011). This requires mastering a set of knowledge of the latest scientific advances in the training of highly qualified athletes.

The system of sports training of basketball players should reflect in full and take into consideration the actions that a sportsman performs in the course of the competition (Doroshenko et al., 2019; Koryahin et al., 2016). Modern basketball requires from sportsmen high functional training and perfect mastering of all techniques of the game (Tsamourtzis et al., 2002). It has been proved (Koryahin et al., 2016; Savoy et al., 1997) that physical training and its organic interconnection with technical training is of great importance for the growth of basketball players' skills. Technical training determines the effectiveness of the training process (Cañadas et al., 2015; Villani et al., 2017). The scientific substantiation of this interconnection enables to effectively prepare basketball players of high class in the course of many years of training.

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2. Methods

Participants. Basketball players of all ages and qualifications were involved in the study, and namely: young basketball players aged 11 to 17 years old in the following quantity: 11 years old – 105, 12 years old – 101, 13 years old – 115, 14 years old – 101, 15 years old – 102, 16 years old – 101, 17 years old – 109 and skilled basketball players aged 18-19 years – 17 persons, 20 years old and older – 74 basketball players who were of masters of sports and honoured masters of sports. The study was conducted in compliance with the World Medicine Association declaration of Helsinki: Ethical principles for medical research involving human subjects, 2013.

Procedures. In order to conduct the study, tests were used to assess the technical and physical fitness of the basketball players (Mancha-Triguero et al., 2019).

In order to assess the technical fitness, the following was used: movement in a defensive stance, push-passing the ball in a give-and-go play with two hands and an over-arm pass with one hand within 30 seconds at a distance of 2 m from the wall, foul shots, jump shots, a complex exercise in running, passing, catching, driving and throwing the ball into the basket, running for 20 m, standing long jump, height of jumping up with pushing of two legs, 3x40 sec running on the basketball court after 1 minute of rest. All tests meet the basic criteria of the theory of tests.

The assessment of the physical development of the basketball players was carried out using the anthropometry method for measuring the size and mass. The hand strength was determined by the method of dynamometry. Spirometry was used to determine external respiration.

Statistical analysis. All statistical analyses were performed using SPSS Version 21. For each characteristic there were determined average values, standard deviations, and Student criterion for unrelated samples.

3. Discussion

Based on the analysis of studying this issue (Ben Abdelkrim et al., 2010; Köklü et al., 2011; Kuczek et al., 2013), it has been established that the rapid development of achievements in world sports requires continuous search for new and more effective means of technical and physical training of basketball players. The assessment and analysis of the system of training and the results of the performances of the world's strongest sportsmen (Ben Abdelkrim et al., 2010; Kuczek et al., 2013; Villani et al., 2017) show, that success can only be achieved as a result of many years of training. It has been found out (Mulazimoglu et al., 2017), that it is precisely in adolescence that the formation of the foundation for further development and improvement of physical qualities takes place, on which the formation of basketball players' skills will depend in the future (Cañadas et al., 2015). That is why it is necessary to help remove disadvantages in the level of physical development and physical fitness of young sportsmen already at the early stages of many-years training.

The topicality of the study is stipulated by the need for an analysis of the existing system of physical and technical training of young basketball players, which makes it possible to purposefully select means and methods of training to improve the structure of complex training on a scientific basis.

4. Results

The study of the growth indicators of young basketball players in Ukraine showed that the height at the age of 12 and 13 years may be classified as a good level, and the height at the age of 15-17 years old is "below average" and is: at the age of 15 years old – 181.9 cm, at the age of 16 years old – 187.6 cm and at the age of 17 years old – 190.6 cm. The growth rates of young players at the age 18-19 years old (196.4 and 199 cm respectively) may be classified as optimal rate.

It has been found out that the growth indicator of young basketball players standing on tiptoe with a stretched up hand increases with age from 189.1 cm to 267.1 cm at the age of 19 years old and up to 269.2 cm in basketball players who are honoured masters of sports and masters of sports of international class. The dynamics of this indicator and growth rate are shown in Figures 1, 2. The obtained results make it possible to state that, until the age of 17-18 years old, basketball players generally reach the limit values of these indicators. It has been found out that the dynamics of these indicators has linear dependence up to the age of 17-18 years old.

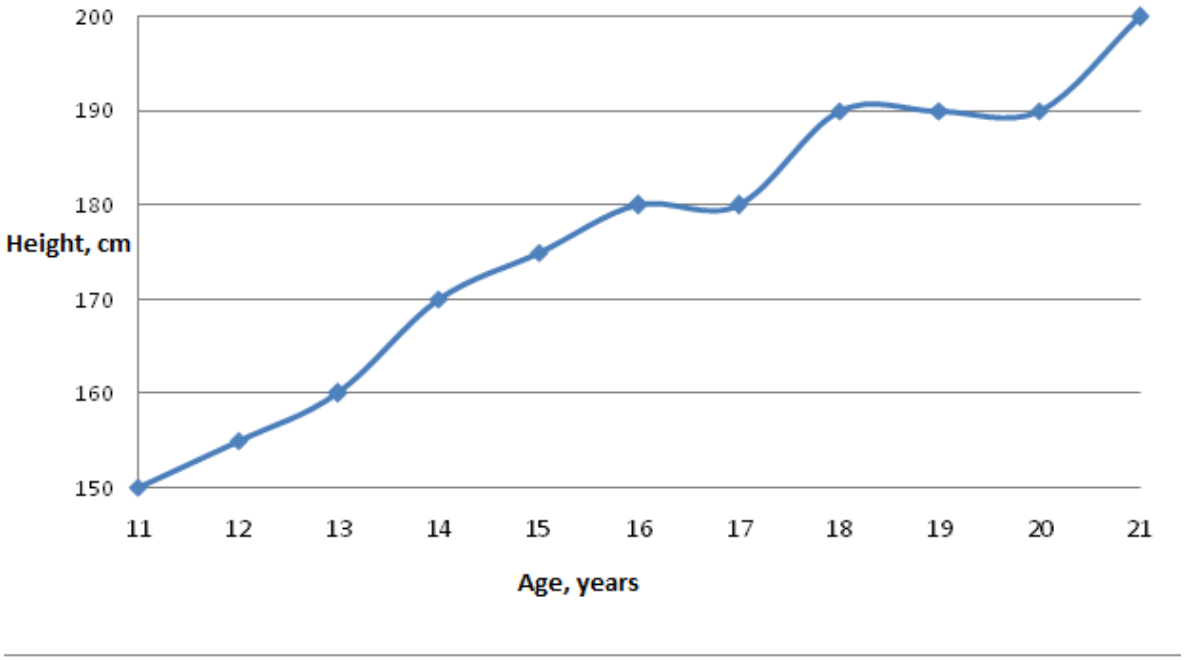

Fig. 1. Dynamics of growth rates of young basketball players

Results in the tests that characterize the speed-strength fitness of sportsmen show that in general, young basketball players in Ukraine have low indicators in the height of jumping up (Figures 3 and 4).

The young basketball players' low indicators in the relative height of jumping up, as well as other speed-strength indicators have been received. The following results have been obtained by testing the relative height of the in basketball players' jump: 11 years old players – 32.17 cm, 12 years old players – 36.8 cm, 13 years old players – 42.00 cm, 14 years old players – 43.10 cm, 15 years old players – 46.90 cm, 16 years old players – 48.40 cm, 17 years old players – 49.90 cm, 18 years old players – 54.00 cm, 19 years old players – 55.00 cm. A similar picture is observed in the indicators of 6 and 20 m running and a standing upward jump off both feet.

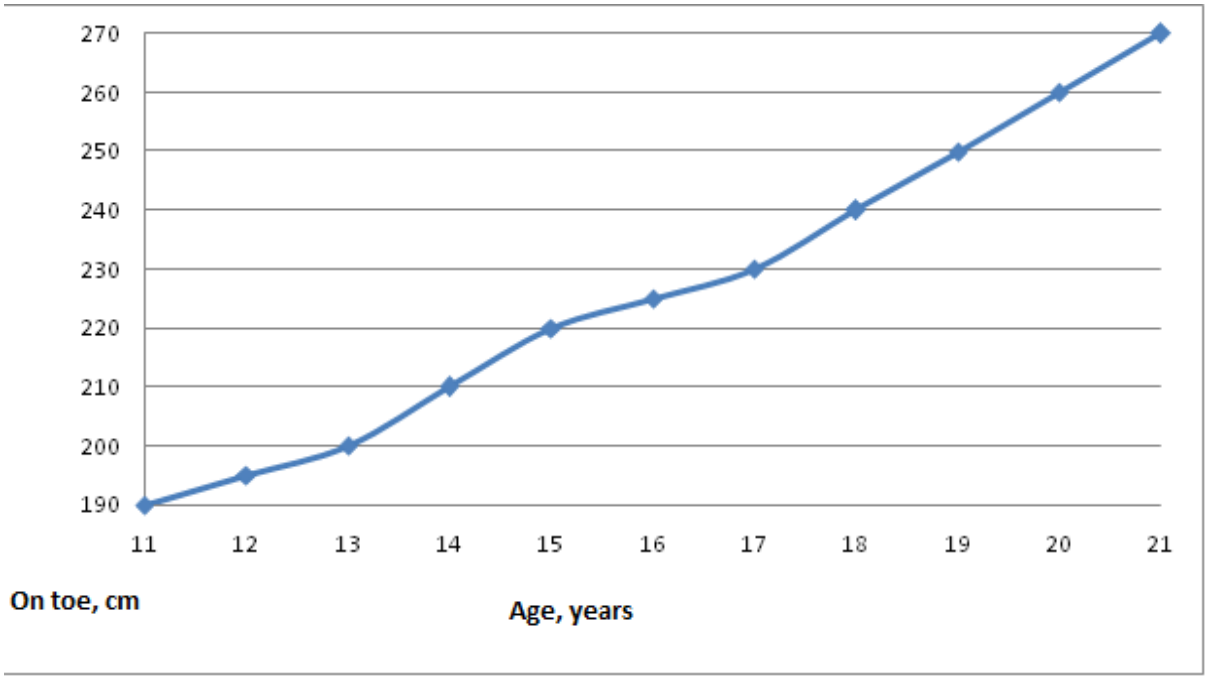

Fig. 2 Dynamics of growth rates on tiptoe with a stretched hand up

The results of the study revealed that the level of development of high-speed endurance is gradually increasing from year to year up to 17 years. 18 and 19 years old basketball players of high qualification (masters of sports) have much higher high-speed endurance. This is evidenced by the results shown in Figure 5.

The studies of the level of technical fitness of young basketball players have shown that their individual indicators have a low rate of growth from year to year. So, the percentage of growth in 17 years old players in the movement in a defensive stance in relation to 11 years players was 21.50. The results of the study have shown that young basketball players, especially 14-15 years old players, have a small range of techniques. Young basketball players have a low level of skills of over-arm passing a ball with one hand, especially with the left one.

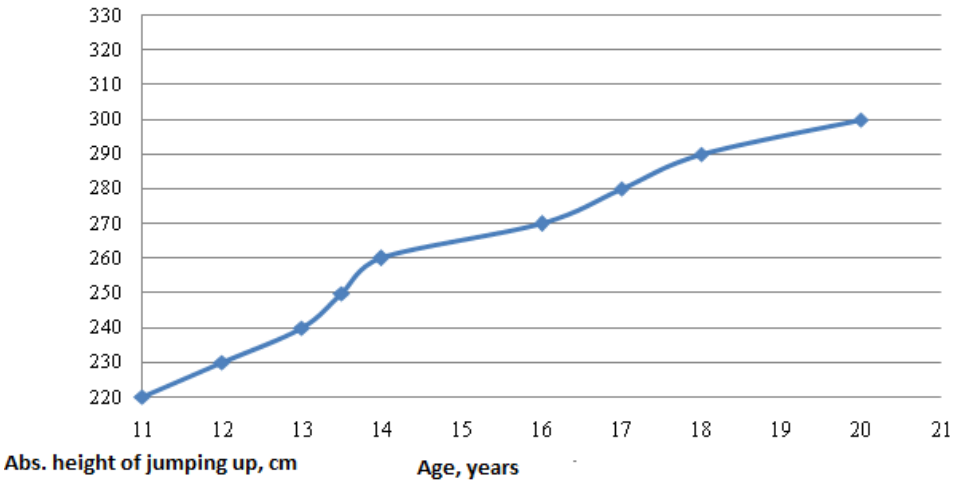

Fig. 3. Dynamics of indicators of absolute height of jumping up of young basketball players

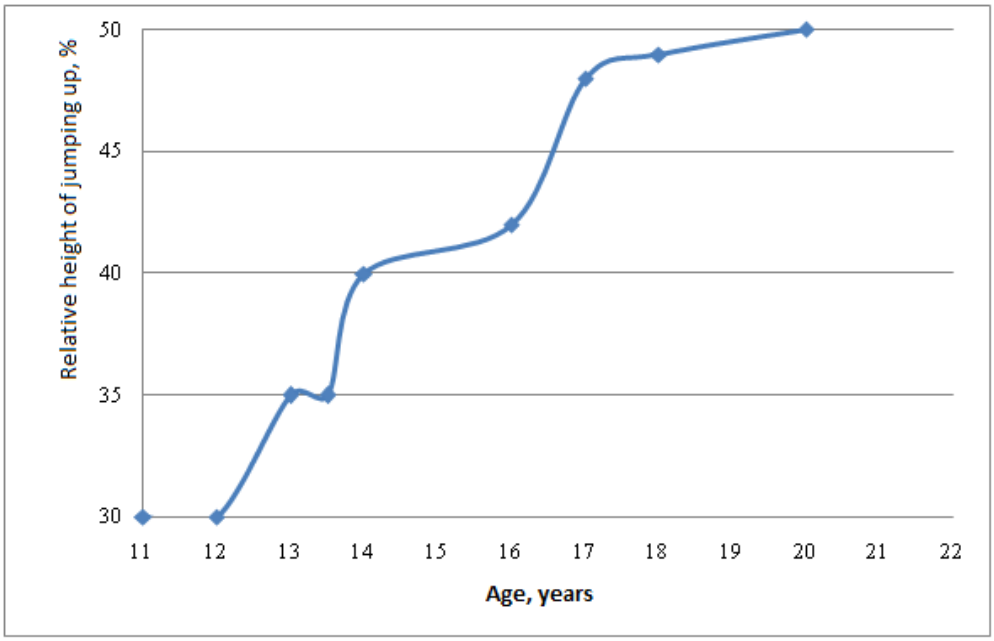

Fig. 4. Dynamics of indicators of relative height of jumping up of young basketball players

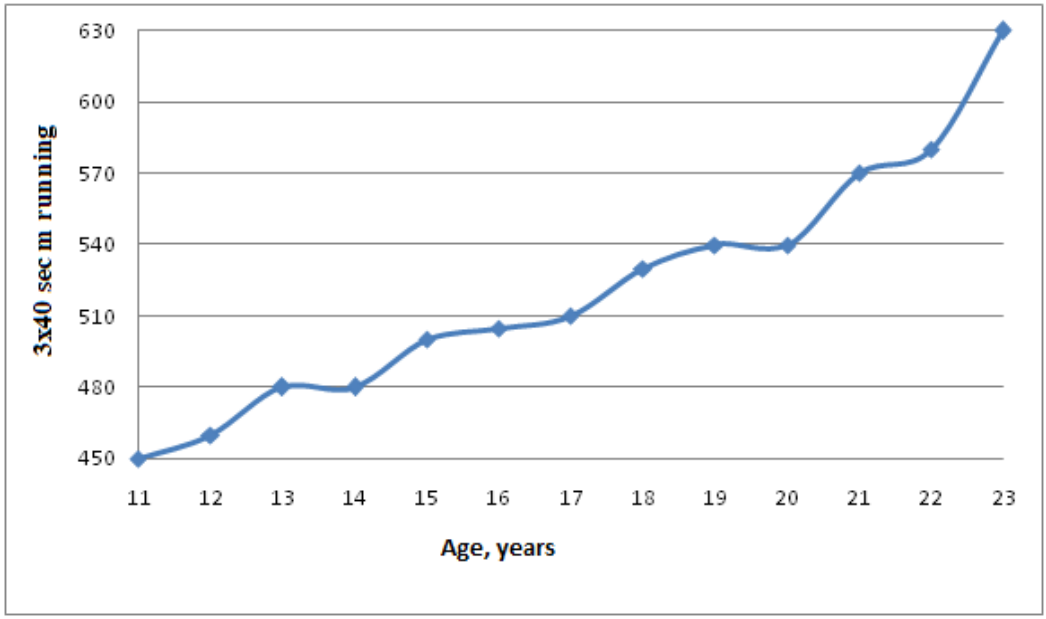

Fig. 5. Dynamics of indicators of speed endurance of young basketball players

Concerning other indicators of technical fitness, the rate of growth is higher from year to year, but in general, young basketball players have low rates in tests that characterize the development level of techniques. It has been found that the percentage of foul throws performed by the young basketball players was: 11 years old players – 24,70; 12 years old players – 31,90; 13 years old players – 35,10; 14 years old players – 50,30; 15 years old players – 53,60; 16 years old players – 58.00 and 17 years old players – 67.00 %.

The analysis of the obtained results allows us to conclude that the selection work should be raised to a higher level. This conclusion confirms the available data in the literature (Cañadas et al., 2015; Khlifa et al., 2013; Mulazimoglu et al., 2017).

The study of the growth rates of young basketball players has shown that they are generally at a level that is lower than recommended by the programs (Savoy et al., 1997; Tsamourtzis et al., 2002). The results of the growth indicators in different age categories are explained by the fact that basketball players of high qualification participated in the surveys in groups of 18-19 years old players, while in other age categories indicators of young basketball players of mass grades were used.

A very important indicator is the height of standing on tiptoe with a hand stretched up (Csataljay et al., 2009; Koryahin et al., 2015). Their importance lies in the fact that they allow taking into account such a factor as the length of the hands and feet.

It has been established that, in comparison with other sports (especially volleyball players) (Savoy et al., 1997), basketball players of high qualification have low indicators of the relative height of the jump. Naturally, this also affects the absolute height of the jump, which in basketball players gets stabilized till the age of 18 years old (Hoare et al., 2000).

On the basis of the obtained results, special attention should be paid to the level of development of high-speed endurance. Consequently, at the age of 11-17 years old, it is necessary to look for opportunities for increasing the efficiency of the training process concerning the development of high-speed endurance. This is consistent with the available literature data (Ben Abdelkrim et al., 2010; Castagna et al., 2007; Csataljay et al., 2009; Savoy et al., 1997).

In general, the study of technical and physical fitness of young basketball players of Ukraine at the age of 11-19 years old has shown that they are generally at a lower level, than recommended by the existing programs (Koryahin et al., 2016). The best indicators can be belong, first of all, to the indicators of 18-19 years old players (Erculj et al., 2009).

According to the range of techniques used, it has been found that at the age of 17-19, the basketball players should master the maximum number of techniques of the game (Cañadas et al., 2015; Tsamourtzis et al., 2002). In this regard, it is necessary, in our view, to review the approaches to assessing the effectiveness of the work of trainers. One of the main criteria for assessing the effectiveness of their work should be the degree of compliance of young basketball

players with model characteristics (Dale et al., 1996; Hoare et al., 2000), among which the leading place belongs to a wide range of technical fitness. The tests used to assess the level of technical as well as physical fitness should cover a wider range.

5. Conclusion

1. The insufficient development of all physical qualities increases the duration of the formation of special skills during mastering the techniques of the kind of sports and reduces the effectiveness of their use in competitive games.

2. Rather low indicators that characterize the growth of sportsmen indicate a low level of selection work. The level of development of high-speed endurance in young basketball players at the age of 11-17 years old indicates that it should, taking into account the tasks of technical training, look for opportunities to increase the effectiveness of the training process in terms of development of high-speed endurance.

3. The low level of technical fitness and weak growth rates from year to year reduce the ability of young basketball players to master hidden passes and a number of other techniques.

4. The lack of due attention to the age-old peculiarities of young basketball players and to the distribution of the amount of time for training, and especially technical training, is aggravated by the fact that teams of 12-14 years old basketball players are formed in the Youth Sports School, due to which early specialization begins, which is focused on the formation of players for a certain role and training them to participate in the competition. There is no consistency or full scope in the development of the techniques, skills or formation of originality in it.

5. Along with the introduction of normative indicators in full concerning physical and technical fitness, rational distribution of time for all types of training by years of training and improvement of the competition system will allow to significantly increase the level of work with young basketball players in terms of their long-term training.

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The Bridge between Abstract Biomechanics and Tennis Strokes

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Abstract

Abstract biomechanics, by definition, are biomechanics *in theory*, without any *application* (therefore a geometrical representation of movement). When referring to (abstract) biomechanics and to (applied) technique ("technical form") their relationship is blurred, not to mention there is no method to effectively make the transition from the former to the latter. In this paper, these terms are explicated and the connection between them is restored through a bridge, called the *operating principle* or *mechanism* of the technique. The exemplary field of application is the sport of tennis. In tennis, the operating principle is not of course all that is needed to develop technical form (the application of the theoretical model on one's body). It is the first step from at least three more, the other ones being the "reference points" and the shot teaching mechanism (the latter being substantially different from the mechanism of the technical form presented here). However, the idea of the operating principle (of the technical form) has never been presented before for any sport. The implications of these insights are important both methodologically and for the development of a teaching method for tennis technical form. Finally, this paper itself bridges two gaps: theory to practice and epistemology to science.

Keywords: technique, operating principle, biogeometrical model, methodology, structure.

1. Introduction

Abstract biomechanics is the application of mathematical modelling to the mechanics of biological effectors resulting in archetypical, or mathematical, descriptions of movement (abstract structure* – *cf.* Gr. *domē*). When such descriptions are expressed as actual movements by e.g. humans (in the case of sports), these resulting movement are called the *technical form*, or simply, the *technique* (concrete structure – *cf.* Gr. *domēma*). But how do we get from the abstract model to the actual (concrete) tennis shot? We go through *bridging principles* (abstract layout of the process of structuring – *cf.* Gr. *domēkē)*. These principles are what this paper will cover. The way this transition from abstract structure to concrete structure is practiced is called *training* (the actual process of structuring/building – *cf.* Gr. *domēsē*). In this process of *domēsē* one may also find the idea of *reference points* which function as a kind of physical anchors for the easier and more precise acquisition of the technique (discussed in more detail in: Papageorgiou, 2020c). Finally, one also needs the "essence" of the teaching method, called the *shot-teaching mechanism*, which is a key-constituent of the learning process. The general interconnection of the various parts of the

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* As is explained in this paragraph, for the four distinct concepts related to Lat. *structura*, Greek language has four words instead of one. Latin-derived languages miss this symmetry and this is oftentimes expressed as deficiency in their theoretical structures.

teaching method partly discussed here are presented in (Papageorgiou, 2020e). Training in order to become a motor expert is the content of the Distal Method and has been covered in various papers (Papageorgiou, Papadopoulos, 2018; Papageorgiou, 2019, 2020a, 2020d).

This paper is based on the specific methodological conception about sports biomechanics presented in an earlier article (Papageorgiou, 2020b). According to this Classical Epistemological approach, we do not make biomechanical models for technique by means of observation or by copying professional players. What we should do is select certain, initial conditions (by whatever criterion we deem appropriate) and develop a model irrespective of the "real world". After we finish developing it in abstraction, we may go back to the world and try to fit our observations to our model – without altering the model, since it is forbidden to verify or to falsify theoretical models by means of observation. This might not be in line with some popular, save delusional conception of science, but it is in line with how mathematics work, implying here that some popular, save superficial interpretation of science and mathematics are incompatible as far as methodology is concerned. Logic, which is the very foundation of both mathematics and science, forbids us to go from the effect (observation) to the cause (theory), a logical fallacy known as "begging the question". Another obstacle confusing us about the relationship between theories and the world is what we mean in English when referring to "structure": ideal structure or concrete structure; *domē*, or *domēma*?

When it comes to tennis biomechanics, the main article presenting the biomechanical model for tennis was Papageorgiou, 2016. Taking into consideration the basic biomechanical principles, it analysed the contact point (or contact "period") in a serial kinetic chain. The main consideration was how to maximise the kinetic energy transfer to the ball during that period. This was called Critical Force Maximisation (CFM). Some important conclusions about CFM were:

- Using the wrist was discouraged
- Last joints were actively decelerated to induce the whip effect
- A kind of double kinetic chain was encouraged. In this case the serial kinetic chain starting from the hips was coordinated with the forward weight transfer.

Building on that, we shall see how the elemental biomechanical components of basic tennis strokes play out. The purpose is to bridge the gap between biomechanics and technical form; however, we shall see neither biomechanics nor technical form but only the bridging principle that connects them. It is the first time such a bridging principle is proposed.

This bridging principle is also called the *operating principle* (or "mechanism") of each tennis shot. As the operating principle of shots, we define the main and most efficient mechanism of producing kinetic energy that will be used to achieve the CFM upon contact. The mechanism is fundamental, simple and universal, i.e. may be applied to different technical models. Next, we shall see the mechanisms for forehand & backhand (one and two-handed) drives, service (a basic flat serve) and underspins. The applied model presented here is *biogeometrical*, i.e. some interpretation of geometry on human movement. Without getting into too much detail in this paper, we shall also see some examples of how the operating principles are transformed to tennis shots.

2. Results and discussion

From biomechanics to tennis shots

In the beginning of biomechanics, there are the mathematical models. The models themselves do not dictate their application; mathematical models are fully abstract with no meaning whatsoever for the reality (this is why a certain model may be used now in physics and in a million years in economics as well). The said mathematical models, the ones used by biomechanics, have been developed in abstraction without any concern for the world or for their future applications or their non-applications. This is the case for any other mathematical model as well. Only afterwards do we assign phenomena to mathematical models. This way, there will always be errors; however, the errors are not mathematical in their nature (the abstract model is never wrong) but practical (bad fit between the model and the phenomenon). So, we still use other mathematical models (e.g. from approximation theory or from statistics) to deal with the world's uncertainty (which is not a mathematical uncertainty).

A direct, or indirect, application of mathematical models, but also of physiology, is the production of a series of "biomechanical principles", such as the applied Newton's Laws, Range of Motion, the Kinetic Chain etc. (Bloomfield, Ackland, 1994; Knudson, 2007). These principles are in

between the world and the full abstraction of theory. Therefore, such principles are ideal for us to bridge the gap between theory and practice, and to be used as the basis of our own bridging/operating principles.

The main two principles that are of interest to us here are, the Biomechanical Advantage, which refers to efficient body positions, and the Kinetic Chain principle stating that each movement is the result of a certain coordination pattern of at least two body segments. These body segments are connected just like the different rings of a chain and movement is transmitted through them. This coordination pattern may be said to be serial, one-unit or mixed (or simply, uncoordinated!).

The operating principle concerns the most important part of that chain, the one that is more characteristic to the movement, so to speak. In the Distal Method, this segment is central for the successful development of the technical form, i.e. the application of biomechanics to a tennis shot. The reasons are:

- It concerns the closest segment to ball contact.
- It may be used as a steppingstone for the player to concentrate on while learning.
- It represents the simplest action performed in the corresponding tennis shot.

Why is the choice made here so strong? Why not some other movement? Because it is the simplest possible movement with the maximum biomechanical advantage and one does not need to "prove" why we begin from the simplest movement but, on the contrary, one should convincingly demonstrate, why there is a need to take, as a starting point, anything more complex than that.

For simplicity, the operating principle does not take into consideration the first body segments in a kinetic chain analysis and may equally work with unit or serial kinetic chains. Later on, while practicing the movement, the focus will also be on, how to coordinate the movement (described here as the operating principle) with the rest of the kinetic chain (and this is an implication for practice).

The presentation of the operating principles of three basic tennis shots will be attempted next. The mathematical models used in this paper are geometrical and their depiction is in the form of applications on the human body.

Drives

The arm is used as a catapult. There are two extreme cases, one moving in the (para)sagittal and one in the transverse (thoracic) plane (depending on the ball height). All other cases are combinations of these two extremes to various degrees. In the sagittal plane, the pivot point is on the frontal axis (at the height of the shoulder), whereas in the transverse plane the pivot point is the longitudinal axis. Figure 1 shows the simplest case of arm rotation in the sagittal plane.

In the simplest case (less Freedom Degrees – DOF) of the sagittal-plane movement, acceleration in the forward movement (that is of interest to us) is enhanced by:

- Body musculature (early phases)
- The gravity (medium phases)
- Whip effect (later stages)

The whip effect is the acceleration of the next, lighter segment of a kinetic chain when the previous segment rapidly decelerates. This will be more obvious in the technical interpretation of the biomechanical model. For now, the whip effect is simply induced by the very length of the arm. The arm is elastic and can both increase and decrease in length. This is under conscious control: we may touch a wall with our hand fully extended and then contract it without moving our body, and while keeping it fully extended, we do not touch the wall anymore (Figure 2). From then on, engaging previous body segments (e.g. legs) in proper synchronisation, will accelerate our arm even more.

In the transverse plane, all previous apply, except from the gravitational acceleration which now has no effect being a vertical force. However, the kinetic chain may provide all the necessary acceleration for equally effective strokes.

The cases of forehand and one-handed backhands are the same in that respect (Figure 3). Even two-handed backhands may be reduced to the aforementioned cases if we assume that the non-dominant arm executes the same movement as the dominant arm in all the one-handed cases. Note: for "winners" and other high shots the operating principle is similar but the arm moves on the horizontal plane (not shown here).

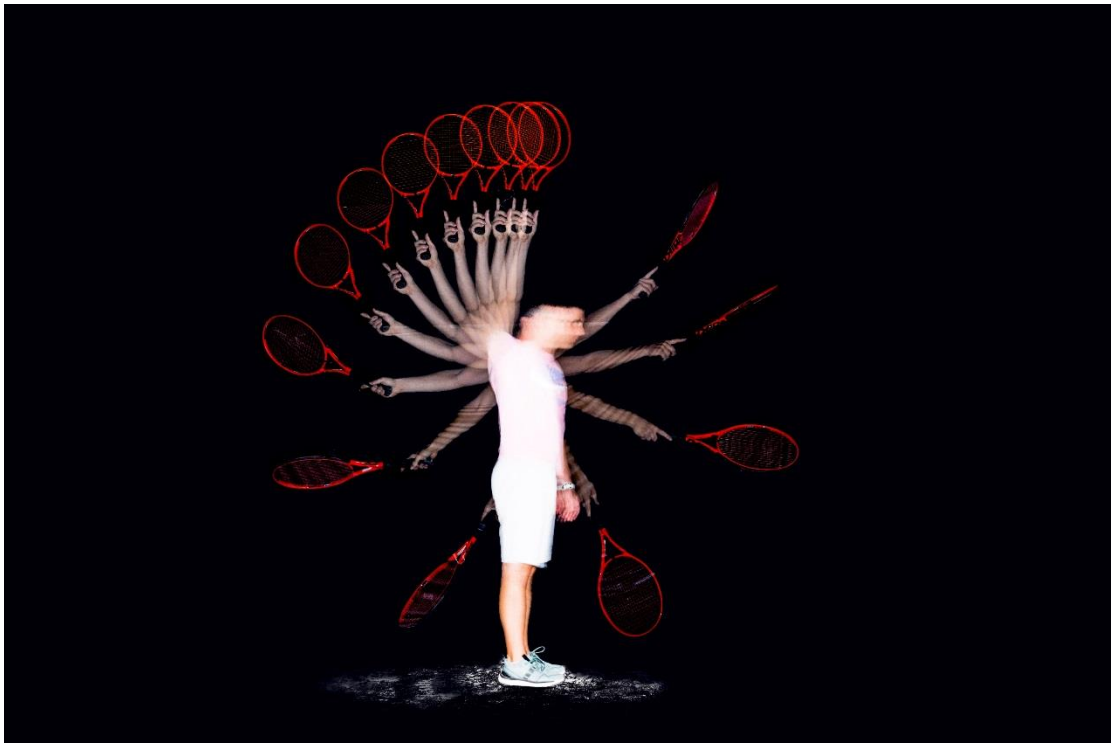

Fig. 1. The operating principle of forehand drive in the sagittal plane.
The arm rotates counter clockwise

Fig. 2. The isolated reach of the arm

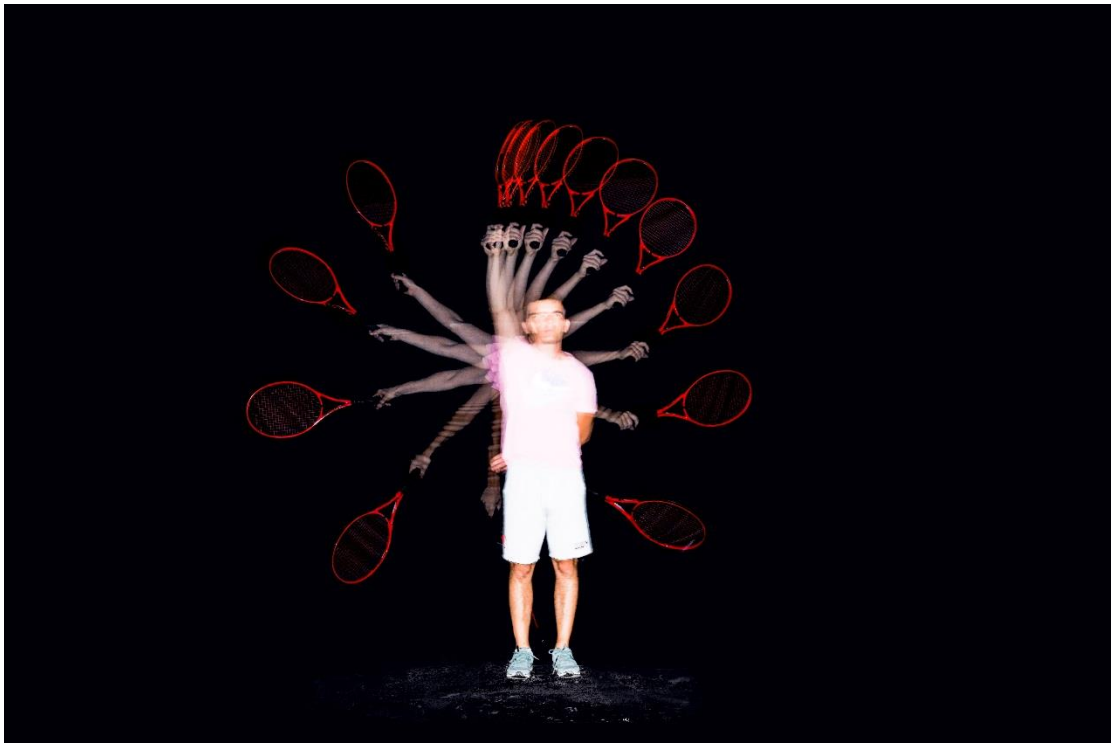

Fig. 3. The Operating Principle in one-handed backhand drive.
The arm rotates clockwise in the frontal plane

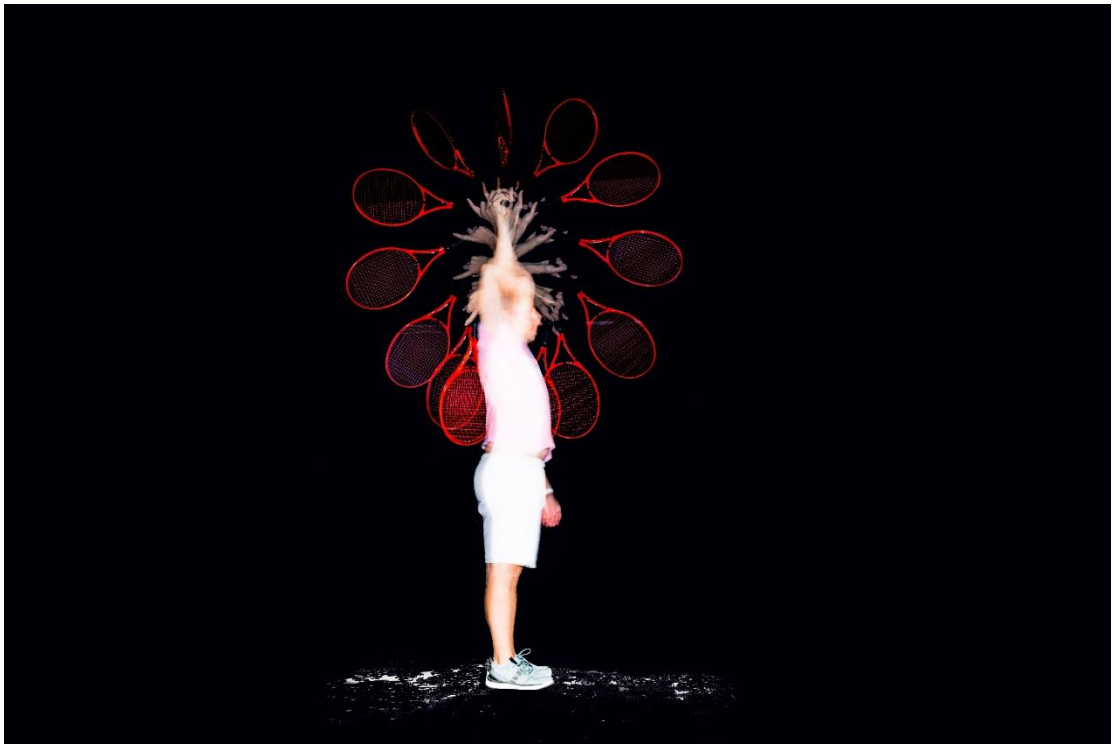

Fig. 4. 180° pronation on the sagittal plane. The movement is clockwise
and the elbow remains in the same height

Service

We shall examine the case of a first, flat serve. In this case, the motion is on the sagittal plane. The frontal axis of rotation is on the level of the elbow; the elbow is located distally, in the maximum height of its trajectory due to the kinetic chain.

Because the body blocks the movement of the racket in the sagittal plane, the movement starts in the frontal (coronal) plane while the body is positioned sideways (in relation to the net). Halfway through the movement, the body changes direction to face the net. From then on, the movement of the lower arm-racket system unfolds in the sagittal plane.

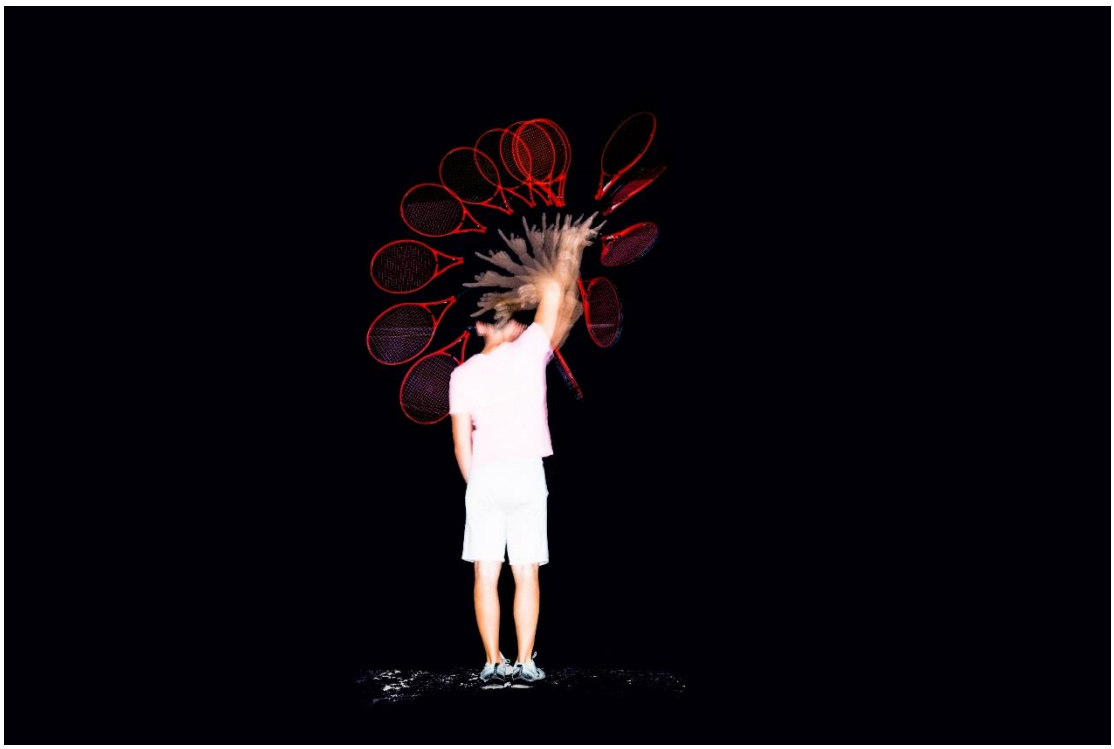

Fig. 5. Rotation (counter clockwise) in the frontal plane maintaining the elbow at the same height

Underspins

The underspins category includes various shots with the same kinesiology: volleys, drops slices. All of them have the same operating principle (their difference, apart from the different swing length, but *not* swing path, is solely on the inclination of the racket's face upon impact).

The operating principle of underspins is that of a *pendulum*. The arm is like the thread (straight) and the shoulder is the pivot point. The wrist is constantly fully extended and the face of the racket points upwards when the arm is in the vertical position, almost touching the body.

The movement of the arm is neither backward (sagittal plane) nor sideways (coronal plane). It is in between these two planes, so it is a diagonal movement going backwards and sideways. Figures 6 and 7 depict the operating principle for backhand underspin's and Figure 8 for forehand underspins.

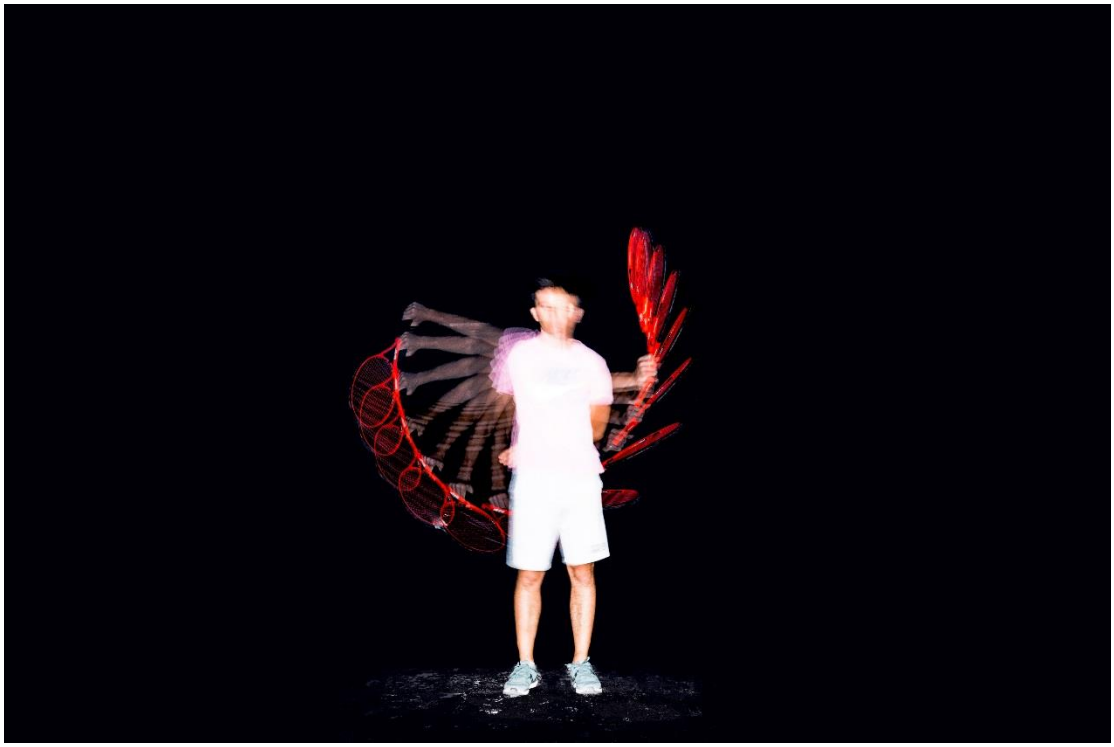

Fig. 6. The Operating Principle of backhand underspins. The rotation happens clockwise and the plane is an intermediate between the frontal and the sagittal plane

Fig. 7. The Operating Principle of backhand underspins seen from another angle where the rotation (clockwise) between the frontal and the sagittal plane is more evident

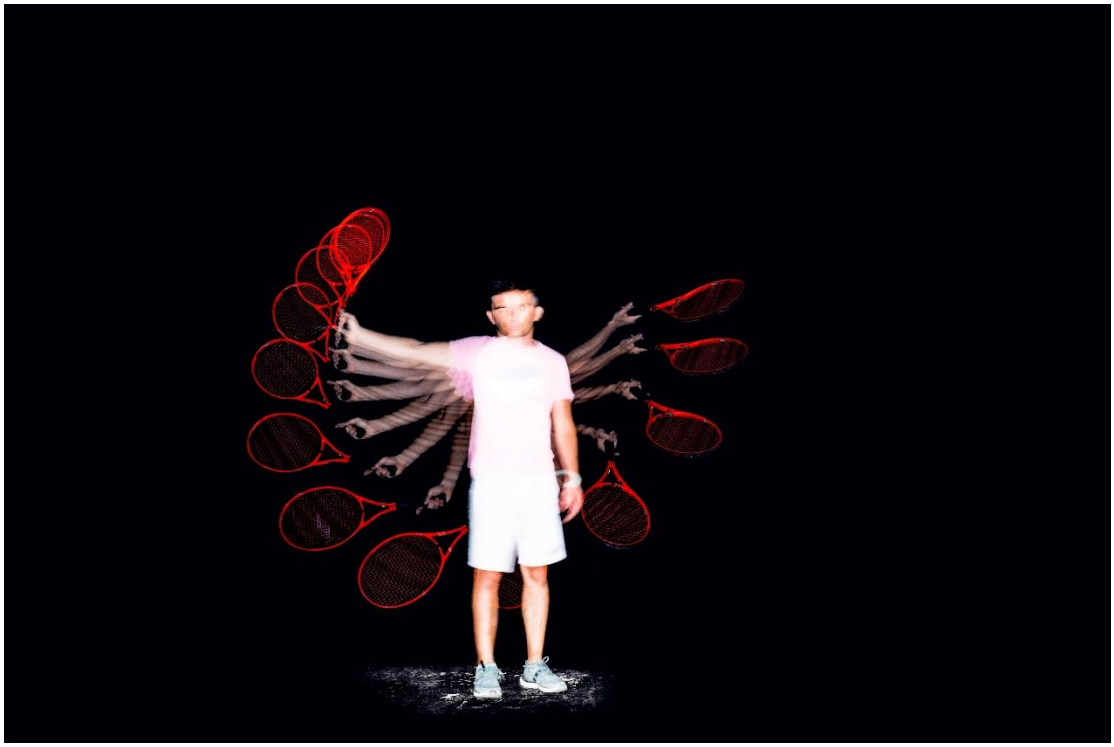

Fig. 8. The forehand underspins' Operating Principle in the frontal plane (rotation: counter clockwise)

In the sport of tennis there is a lack of properly structured biomechanical models. In popular magazines, what is presented as "technique" (in the most general sense) is just a video analysis of some player, exactly the way mathematical methodology forbids us to do. I mean, it is OK for a popular magazine to present a case study, but in no way can observations or measurements, accompanied by numbers and equations, be called "models" and have any regulatory power from then on. This is a logical fallacy known as "begging the question" and its formal formulation is:

$$\nvdash ((A \to B) \wedge B) \to A$$

Which is a foul interpretation of the valid *modus ponens*:

$$\vdash ((A \to B) \wedge A) \to B$$

In the literature then, not much can be found regarding tennis biomechanics leading to some kind of proposed technical form, save from observations, measurements and some references to biomechanical principles in general (Elliott et al., 1989; Kleinöder, 1997; Bahamonde, Knudson, 1998; Elliott et al., 2003; Martin et al., 2013; Grambow et al., 2020).

Taking as a starting point Classic Epistemology, a new Paradigm is unveiling in these pages, the first step towards a complete biomechanical model for all tennis strokes. Measurements cannot help in the development of this model; only afterwards technicians are free to measure any player's movement which they think is a good interpretation of this model. Statistics and approximation theory are valid mathematical fields but have nothing to do with either the development or with the evaluation of a model. Similarly, without the prior existence of models, what kind of error do we measure? We set to trace deviation from what? This self-defeating, circular rationale led Classic Greeks to develop the axiomatic method and *epistēmē* to, actually, bypass such problems. The problem was not and is not the accuracy of the measurements. Merely using complicated mathematical formulas to describe a phenomenon is called quasi-mathematicity and is an epistemological fallacy – certainly not a way to increase the validity of a model (Papageorgiou, Lekkas, 2020). The problem lies in the idea of going from measurements and phenomena back to models, archetypes and the *true being* (*ὀντως ον*). This direction is not only false, but also witchcraft and it sets science's clock back more than 2500 years.

Or have we gotten over the Classic Greek Epistemology by relapsing to even more ancient worldviews? If this is the case, why do science in the first place and not go even further back in time

and perform shamanic rituals instead? As I have repeatedly supported, shamanic rituals seem to be more environmentally friendly than many modern scientific practices.

The reason I insist so much in methodology is that a question asked correctly directly points to the correct answer. It is crucial to understand why we ask questions this way and why epistemology works like that: if correctly structured models are rare in sports science, epistemological discussions are even more rare – even absent.

As far as some additional practical implications are concerned, one should keep in mind the general workflow: players use their most basic understanding (through sensing) and perform the shot mechanisms in the form of some simple exercises. Then, we establish a common understanding through specific anchors, called the *reference points* of tennis shots (not described here). With the sensorial understanding provided by the shot mechanism and the clearer mental representation of the important parts of the shot's technical model provided by the reference points, we can now communicate effectively in order to introduce the next tool, i.e. the shot-teaching mechanism which is how we will develop a meaningful technical form. From then on, "knowing" or "understanding" the form of one or more tennis shots, it doesn't mean we have learned the game of tennis. To achieve that, we introduce drill-synthesis, which, for example, includes random and blocked practice. Drill-synthesis helps players to combine shots or to move while hitting the ball. However, hitting shots while moving is not the game of tennis, in the same way that effectively pressing different keys on a keyboard to write correct words does not make someone a writer or a novelist. So, the next step is drill-structure which goes far beyond the scope of this paper. I just attempted to describe a simplified whole-picture of the process – a process that includes even more tools in the complete tennis Distal Method (e.g. motowords, two double models for motor skills and physical form development, two periodisation tools called performance spirals).

Impact and medical perspectives

This paper, points towards a holistic training system which is based on a sound biomechanical model produced in the way theory dictates, that is, not based on observations but based on *initial conditions* (Papageorgiou, Lekkas, 2018). For tennis, it is the first time a model of this kind has been proposed.

Optimal biomechanics is necessary for both performance and injury prevention (Joshi et al., 2011; Kancherla et al., 2014; Ae, 2020). Any training system should have at least two fundamental components: a sound biomechanical model *and* a method for teaching that model; the former belongs to the domain of biomechanics and the latter to the domain of motor learning and performance. The Distal Method has these two components in its very core, supported by other important tools (related to physical form, periodisation, pedagogy, mental skills training etc.).

3. Conclusion

The general concept of "technique" is broken down into biomechanics, bridging/operating principles and technical form and the relationships among these, oftentimes confused concepts have been attempted to be cleared. In this paper, our focus was on the bridging principles. These same principles may also be presented using much heavier mathematical jargon, a task fit for anyone interested; however, my hunch is that such an endeavour would not shed more light, but rather formalise more what has been described here in a simpler geometrical manner, which is also mathematical. Future research should concern the development of models for technical form within the paradigm presented in these few pages. An interesting question that may be answered in another paper would be if there is also a bridge between the final product described in this paper (technical form) and the technical style (a concept which has not been mentioned at all). Technical style is the personalised type of technical form that results after years of training of the technical form and after the individual has adapted the form to their own body-levers, preferences etc. One could say that a specific technical form is characteristic of a certain School, whereas a specific technical style is characteristic of specific individuals (usually expert players). Technical form is taught directly whereas the technical style develops "naturally". So, can we conceive of a bridging principle between these two concepts?

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