

ANALYSIS OF THE EFFECTIVENESS COEFFICIENT IN GRECO-ROMAN FIGHTING ATHLETES AT DIFFERENT LEVELS OF COMPETITION

ANÁLISE DO COEFICIENTE DE EFETIVIDADE EM ATLETAS DE LUTA GRECO-ROMANA EM DIFERENTES NÍVEIS DE COMPETIÇÃO

ANÁLISIS DEL COEFICIENTE DE EFICACIA EN ATLETAS DE LUCHA GRIEGO-ROMANA EN DISTINTOS NIVELES DE COMPETICIÓN

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ABSTRACT

Introduction: Wrestling is an ancient combat sport, individual and of complex performance, which integrates high technical and tactical complexity, associated with a bioenergetic interaction and a high coordinative pattern. In Brazil, the number of competitors at different levels has increased significantly in the last years, evidencing the need to search for answers that can help coaches in the different situations of the competitive calendar. The prescription of the means and methods of training in Greco-Roman wrestling aims at the development of the technical effectiveness. However, there is no evidence of indicators of technical effectiveness, in Brazilian elite athletes of Greco-Roman wrestling, in national and international competitions. **Objectives:** The objective of the study was to verify and to compare the technical effectiveness of the wrestlers of Greco-Roman fight of the Brazilian selection, in two competitions: one in the national level and the other international. **Methods:** Seven athletes of the Brazilian wrestling team participated of the investigation (age: 25±5 years; stature: 175±12 cm; corporal mass: 80± 21kg). Analysis of the effective, not effective and total technique were accomplished. After identifying the normality of the data (SHAPIRO WILKS), the Student's t test was used to compare the variables, according to the moment evaluated, considering the significance level of 5%. **Results:** The results showed a significant decrease ($p = 0.03$) in the standing effective technique and in the total effective technique ($p = 0.01$), comparing the national competition with the international competition. **Conclusion:** Technical effectiveness of Brazilian wrestlers was found to be below the indices presented in studies with competitors from countries considered to have high world performance. In international competition, it presents a negative impact compared to national events. **Level of Evidence IV; Therapeutic Studies - Investigation of Treatment Results.**

Keywords: Athletes; Energy Metabolism; Athletic Performance; Wrestling.

RESUMO

Introdução: O Wrestling é uma modalidade de combate milenar, individual e de rendimento complexo, que integra elevada complexidade técnico-tática, associada a uma interação bioenergética e um alto padrão coordenativo. No Brasil, o número de competidores em diferentes níveis aumentou significativamente nos últimos anos, evidenciando a necessidade da busca de respostas que auxiliem os treinadores nas diferentes situações do calendário competitivo. A prescrição dos meios e métodos de treinamento na luta greco-romana visa o desenvolvimento da efetividade técnica. Entretanto, não há evidências de indicadores de efetividade técnica, em atletas de elite brasileira de luta greco-romana, em competições nacionais e internacionais. **Objetivo:** o objetivo do estudo foi verificar e comparar a efetividade técnica dos lutadores de luta greco-romana da seleção brasileira, em duas competições: uma no nível nacional e a outra internacional. **Métodos:** Participaram da investigação sete atletas da seleção brasileira de luta greco-romana (idade: 25±5 anos; estatura: 175±12 cm; massa corporal: 80± 21kg). Foram realizadas análises da técnica efetiva, não efetiva e total. Após identificar a normalidade dos dados (SHAPIRO WILKS), foi utilizado o teste t de Student para a comparação das variáveis, segundo o momento avaliado, considerando nível de significância de 5%. **Resultados:** Os resultados mostraram uma diminuição significativa ($p = 0,03$) na técnica efetiva em pé e na técnica efetiva total ($p = 0,01$), comparando-se a competição nacional com a internacional. **Conclusão:** Concluiu-se que a efetividade técnica dos lutadores brasileiros está abaixo dos índices apresentados em estudos com competidores de países considerados de alto desempenho mundial. Em competição internacional, apresenta um impacto negativo comparativamente a eventos nacionais. **Nível de Evidência IV; Estudos Terapêuticos - Investigação dos Resultados do Tratamento.**

Descritores: Atletas; Metabolismo Energético; Desempenho Atlético; Luta Romana.

RESUMEN

Introducción: El Wrestling es una modalidad de combate milenaria, individual y de rendimiento complejo, que integra elevada complejidad técnico-táctica, asociada a una interacción bioenergética y un alto patrón coordinativo. En



Brasil, el número de competidores en diferentes niveles aumentó significativamente en los últimos años, evidenciando la necesidad en la búsqueda de respuestas que auxilien a los entrenadores en las diferentes situaciones del calendario competitivo. La prescripción de los medios y métodos de entrenamiento en la lucha greco-romana tiene como objetivo el desarrollo de la efectividad técnica. Entre tanto, no hay evidencias de indicadores de efectividad técnica, en atletas de alto rendimiento brasileño en la lucha greco-romana, en competencias nacionales e internacionales. **Objetivos:** El objetivo de este estudio fue verificar y comparar la efectividad técnica de los atletas de lucha greco-romana de la selección brasileña, en dos competencias: una a nivel nacional y otra internacional. **Métodos:** Participaron de la investigación siete atletas de la selección brasileña de lucha greco-romana (edad: 25 ± 5 años; estatura: 175 ± 12 cm; masa corporal: 80 ± 21 kg). Fueron realizados análisis de la técnica efectiva, no efectiva y total. Después de identificar la normalidad de los datos (SHAPIRO WILKS), fue utilizado el test de t de Student para la comparación de las variables, según el momento evaluado, considerando el nivel de significación de 5%. **Resultados:** Los resultados mostraron una disminución significativa ($p = 0,03$) en la técnica efectiva en pie y en la técnica efectiva total ($p = 0,01$), comparándose la competencia nacional con la internacional. **Conclusión:** Se concluyó que la eficacia técnica de los luchadores brasileños está por debajo de los índices presentados en estudios con competidores de países considerados de alto rendimiento mundial. En la competición internacional, presenta un impacto negativo en comparación con los eventos nacionales. **Nivel de Evidencia IV; Estudios Terapéuticos - Investigación de Los Resultados Del Tratamiento.**

Descriptor: Atletas; Metabolismo Energético; Rendimiento Atlético; Lucha.

DOI: http://dx.doi.org/10.1590/1517-8692202430022022_02221

Article received on 05/10/2022 accepted on 06/20/2023

INTRODUCTION

Wrestling means fighting and constitutes an ancient, individual, and complex performance combat modality, which integrates great technical-tactical complexity associated with an equally complex bioenergetic interaction and a high coordinative standard. Furthermore, wrestling is divided into two styles: Olympic and non-Olympic. Regarding the first, there are three: i) Greco-Roman wrestling, ii) men's wrestling, and iii) women's wrestling.^{1,2} All three are on the Olympic schedule, comprising six weight categories each.³ The difference is that in Greco-Roman wrestling, attacks are allowed only from the waist up, and in wrestling and women's wrestling, on the whole body.⁴ Basically, wrestling aims to knock down the opponent without punches, kicks, or traumatic blows, and immobilize him with his back on the ground.⁵ In Brazil, the number of competitors at different levels has increased significantly in recent years, highlighting the need to search for answers that help coaches in the different situations of the competitive calendar.

In Greco-Roman wrestling, the biomotor capacities of strength, agility, and endurance are necessary for the performance of techniques and tolerance to fatigue, for attack and defense, during the confrontation, and should be considered in the training planning.⁶⁻⁸ In a fight with a regular duration of two times three minutes, with an interval of 30 seconds, the balance between the requested variables in the preparation of the Greco-Roman wrestling athlete is extremely important for the wrestler's performance, due to the dynamics that is required, because the relationship between such aspects becomes determinant in the level of competitive performance.^{9,10}

Thus, the prescription of the variables that make up a training program aims at developing technical effectiveness¹¹⁻¹³ and needs to consider several factors, such as biological individuality, training specificity, and the fighter's performance level.^{14,15} Regarding the level, studies point out that technical effectiveness indicators are considered relevant for the organization of training and for the development of performance during the match in the competition.^{9,14} Therefore, among other factors, the number of effective techniques performed in combat has been investigated and pointed out as an indicator for competitive success.^{14,16}

In this sense, competitive activity, the reproduction of which is related to the wrestler's achievement of a certain level of result, is a system-forming factor that determines the structure and composition

of the process of each stage of preparation.^{17,18} Thus, the important characteristics of the confrontation in the modalities of combat between attack and defense are highlighted: effectiveness, volume, and diversity.¹⁹ In this way, the processes of participation in training and competitions are inseparable components of athletic activity¹³ and one of the main conditions of its development for the achievement of sports form.^{4,20} Podlivaev¹⁴ points out that for a high-level competition, the wrestler in the Greco-Roman discipline must possess a range of technical and tactical skills, reliable defense and counterattacks, applying techniques effectively at the beginning and end of the fight (despite fatigue), as well as being able to fight at a high functional level in extreme conditions, attacking the opponent with an interval of 20-25 seconds.

It is known that the effectiveness coefficient index is related to the number of techniques that the fighter hits during the fight.^{4,14} However, other authors, such as Latyshev¹⁸ and Barbas et al,²¹ present in their studies some groups of types of fighters that vary the number of scores according to the way of fighting.

Given this scenario, there is no evidence of technical effectiveness indicators in Brazilian elite Greco-Roman wrestling athletes participating in national and international competitions. Therefore, this study justifies its realization by investigating the technical effectiveness, so that it is possible to understand the level of Brazilian wrestlers, seeking to bring subsidies and information for the organization and planning of the training of these athletes.

Thus, this study aimed to verify and compare the technical effectiveness of the wrestlers of the Greco-Roman modality of the Brazilian team in two competitions of different levels (national and international).

MATERIALS AND METHODS

This observational study involves elite Brazilian wrestlers practicing the Greco-Roman wrestling style. Seven elite athletes participated in the research (age: 25 ± 5 years; height: 175 ± 12 cm; body mass: 80 ± 21 kg), members of the Brazilian adult team, in the categories 59 kg ($n = 2$); 66 kg ($n = 2$); 75 kg ($n = 2$) and 98 kg ($n = 1$).

The study was developed during the Brazilian and Pan-American championships of 2017. Initially, all participants were informed about the study by the researcher in charge and subsequently signed the informed consent form, which was previously approved by the Research Ethics Committee, with opinion number 1,908,571.

Data collection procedure

To evaluate the technical effectiveness of the wrestlers, the matches were analyzed through footage provided by the official entities of the Greco-Roman wrestling modality (CBW and UWW). Analyses were performed on the volume of effective standing technique, effective floor technique, total effective technique, non-effective standing technique, non-effective floor technique, and total non-effective technique. Then, the effectiveness coefficient was determined.²²

The volume of technical actions was considered as the sum of effective techniques, which are the blows that the fighter hit, scoring on his opponent, and associated with non-effective techniques, which are the blows that the fighter applied and did not complete.

The effectiveness of technical actions is measured by the effectiveness coefficient, which is obtained by the volume of effective techniques divided by the total volume of technical actions applied in the fight.

Statistical analysis

The data obtained were stored in a computer database, initially producing measures of centrality and dispersion (mean and standard deviation) of the different variables analyzed, followed by inferential analysis. After identifying the normality of the data (Shapiro Wilks), Student's t-test was used to compare the variables according to the moment evaluated, considering a significance level of 5%.

RESULTS

The results are presented in two parts. The first (Table 1) regarding all the variables studied for each participant and the sum, mean, and standard deviation of the team in the two championships and, next (Table 2) regarding the comparison of the components of technical effectiveness during the two moments evaluated.

The data obtained shows a decrease in the number of fights and average points in favor of the International Championship when compared to the National ($p = 0.01$). On average, the team participated in 3 ± 0.58 fights in the National Championship, while in the International Championship, 2.14 ± 0.69 fights. In the average of points in favor per fight, the team obtained 6.48 ± 1.65 points in the National Championship, while in the International, the average was 4.48 ± 1.22 points.

The analysis of the technical effectiveness variables and their comparison between the championships are presented in Table 2. Notably, the effective standing technique ($p=0.03$) and the total effective technique ($p=0.01$) showed a significant decrease in the number of blows applied in combat, at the international level, with a percentage reduction of 50.0% and 42.1%, respectively.

Table 1. Descriptive data of individuals according to the variables studied.

Individual	Category	Number of Fights		Average points in favor per fight		Effective standing technique		Effective technique on the ground		Total effective technique		Technique not effective when standing		Technique not effective on the ground		Total non-effective technique		Total volume of techniques		Coefficient of effectiveness	
		CN	CI	CN	CI	CN	CI	CN	CI	CN	CI	CN	CI	CN	CI	CN	CI	CN	CI	CN	CI
1	59	3	1	9	4	7	3	1	0	8	3	3	6	0	0	3	6	11	9	0.82	0.33
2	59	3	2	4.6	4	4	2	3	1	7	3	6	6	0	2	6	8	13	11	0.53	0.27
3	66	3	2	6	7	5	5	1	1	6	6	13	4	0	0	13	4	19	10	0.31	0.60
4	66	4	3	6.7	4.3	9	1	3	4	12	5	7	14	0	1	7	15	19	20	0.63	0.25
5	75	3	3	6.6	4.6	8	7	3	3	11	10	6	12	0	0	6	12	17	22	0.64	0.45
6	75	3	2	8	4.5	8	2	2	2	10	4	3	4	0	0	3	4	13	8	0.77	0.50
7	98	2	2	4.5	3	3	2	0	0	3	2	4	6	2	0	6	6	9	8	0.33	0.25
Sum		21	15	45.40	31.40	44	22	13	11	57	33	42	52	2	3	44	55	101	88	-	-
Average		3.00	2.14	6.48	4.48	6.29	3.14	1.86	1.57	8.14	4.71	6.00	7.43	0.29	0.43	6.29	7.86	14.43	12.57	0.58	0.38
Standard Deviation		0.58	0.69	1.65	1.22	2.29	2.12	1.21	1.51	3.13	2.69	3.46	3.95	0.76	0.79	3.35	4.18	3.95	5.88	0.20	0.14

Note: CN = National Championship, CI = International Championship.

DISCUSSION

The proposed objective sought to analyze the technical effectiveness of the Brazilian elite wrestlers of Greco-Roman wrestling through the coefficient of effectiveness at different levels of competitions and, based on the data obtained, the present discussion will be divided into two moments. The first moment highlights the number of fights and the average number of points in favor in the national competition compared to the international one. In the second, the effect of the demands of the level of the different competitions on effective standing technique and total effective technique will be evaluated.

In particular, regarding the number of fights, it was verified in Table 1 that the average number of fights of Brazilian fighters in the national championship was three fights and, in the international championship, two fights. It is worth noting that other studies have shown that in high-level international competitions (World Cup and Olympic Games), a wrestler has to fight five matches to be a medalist.^{14,23}

Regarding the average points in favor, it is known that building the multi-year training system for wrestlers of *Wrestling* is necessary to know the characteristics of the model of the champion's skills.^{6,15} However, as a result of research conducted by experts on *Wrestling* champions can have substantially different combinations of preparation features, which are quite stable.^{20,22} Thus, Latyshev¹⁸ presented a study conducted with 92 Olympic-level wrestlers, divided into seven groups of wrestlers, who scored with approximately similar combinations of such features. In previous works conducted based on the results of the analysis of expert assessments, it can be stated that all high-level sportsmen (wrestlers who won the first five places at the Olympic Games) can be related to one of the seven styles.²²⁻²⁸ The average score in favor of each type of wrestler is: i) *strongman* - 3.5 to 9.6; ii) *full-developed* - 4.2 to 7.8; iii) *highly reliable* - 4.2 to 9.6; iv) *player* - 3.6

Table 2. Absolute values, result of the statistical test and delta percentage of the different variables of effectiveness, according to championship level.

Variable Studied	Championship level		p-value	Δ%
	National	International		
Effective standing technique	44.00	22.00	0.03*	-50.0
Effective floor technique	13.00	11.00	0.45	-15.4
Total effective technique	57.00	33.00	0.01*	-42.1
Technique not effective when standing	42.00	52.00	0.49	23.8
Technique not effective on the ground	2.00	3.00	0.76	50.0
Total non-effective technique	44.00	55.00	0.47	25.0
Coefficient of effectiveness	0.58	0.38	0.08	-33.9

* $p < 0.05$.

to 6.6; v) *binder* - 7.2 to 12.0; vi) *paced at distance* - 6.0 to 10.8; vii) *paced in hold* - 7.8 to 13.8. These approaches indicate that the points in favor per fight vary according to the group of fighters. However, they are indicators that allow the development of individualized training aimed at identifying the particular group's training, development and improvement.²²⁻³⁰

Another study by Iermakov et al.²⁹ points to three other types of wrestlers: "game wrestlers", "powers" and "tempo". *Game wrestlers* score no less than three points to get a win, with powers and tempo generally realizing one or two points to get a win.

In the literature consulted, cited in this study, no studies were found with Brazilian athletes of Greco-Roman wrestling in international competitions. However, the results of the present study indicate that at the International Championships, athletes' performance was impacted.

After the application of the technical effectiveness test, a decrease in the effective standing technique was noted, also verifying that there was a decrease in all the techniques analyzed; other authors had already reported this fact,^{4,14,15} who attributed the athlete's effectiveness index according to the level of competition, especially the motor actions required in the competitive confrontation.^{12,19}

The study carried out by Podlivaev³⁰ describes the characteristics of the technical effectiveness, in an international championship, of the athletes of the Russian national team, considered to be of high level in the modality, pointing out the coefficient of effectiveness between 0.70 and 0.90. Given this information, the data in Table 2 show that the effectiveness coefficient of Brazilian wrestlers is below the values presented, as it presents values of 0.58 in the National Championship and 0.38 in the International Championship. Although there are no statistically significant values, when observing the information regarding the index of the coefficient of effectiveness of Brazilian wrestlers in the international championship concerning the national one, a decrease of 33.9% is noted.

These results show that there may be a relationship between the effective standing technique and the total effective technique with the effectiveness coefficient. In addition, the number of fights and the average number of points in favor can influence the volume of

techniques performed during the fight. Therefore, the analysis of technical effectiveness seems an important tool to monitor the competitive performance of the *wrestler*.

CONCLUSION

It is concluded that, after comparing the components of the technical effectiveness of the athletes of the Brazilian Greco-Roman wrestling team, there was a decrease in all the indices of

technical effectiveness in the international championship compared to the national one, which may have been caused by the demands required by the level of the different competitions, which tends to be higher in international events. The decrease of 50% in the volume of effective standing techniques and 42% in the volume of total effective techniques was the main indicator of a drop in the competitive level of the athletes studied and should be paid attention to by coaches and athletes. The data obtained in this study also indicate that the indices of the technical effectiveness of Brazilian athletes in the national championship should not be used as indicators for international competitions, as they can lead to erroneous prognoses since these indices can suffer significant reductions, related to the increase in the level of competition.

Practical applications

Regarding the monitoring and control of training, the effectiveness coefficient has shown to be an indicator that can help detect the level of the team and the competition. In addition, by identifying the effectiveness coefficient, the coaching staff can define which types of planning and organization should be applied to maximize the training system, always keeping in mind the respective level of the competition system. Thus, supported by the theory and methodology of training, the information pointed out in this study on technical effectiveness can direct to the understanding of the necessary components for performance, contributing to the sports preparation of Brazilian athletes.

All authors declare no potential conflict of interest related to this article

AUTHORS' CONTRIBUTIONS: Each author contributed individually and significantly to the development of the manuscript. TNA and JPB: drafting of the manuscript. FVM, TNA and JPB: discussion of the results; ACC and FCT: critical review of the intellectual content and JPB final approval of the manuscript.

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