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Original article

Physical fitness of young applicants for admission tests in Ecuadorian military schools: study in two independent groups

Condición física de jóvenes aspirantes a pruebas de ingreso en escuelas militares ecuatorianas: estudio en dos grupos independientes

Aptidão física dos jovens candidatos aos exames de admissão nas escolas militares equatorianas: um estudo em dois grupos independentes

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ABSTRACT

Annually, calls are opened for young applicants to the different military training schools; for this, there are certain requirements for the selection of the most qualified personnel for access to these institutions. Among them, various demands related to physical fitness. The objective of the research is to determine the levels and differences in physical fitness between two independent groups of applicants for entrance tests at an Ecuadorian military school. The study is descriptive-correlational with a quantitative approach, carried out in a population of (N=40) young people aspiring to a Military Educational School with similar fitness. These are classified into two independent groups with 20 members each (LN: Liceo Naval; CNC: Colegio Nacional Conocoto). The physical fitness was evaluated through three tests of the National Army of Ecuador. In order to correlate data, the parametric Student's t test was used for independent samples ($p \leq 0.05$) in the elbow and hip flexion and extension tests and the *3219* m endurance *test.* There were significant differences between the two groups evaluated in each *test* ($p=0.000$), which were better means in the group of LN applicants compared to the CNC group. Specifically, the Liceo Naval presented better indicators of physical fitness and, in general, a lack of physical fitness was identified by the applicants of the two independent schools, characterized by low levels of physical activity. This aspect has a negative impact on the results of the admission tests to Ecuadorian military academies.

Keywords: Young applicants; Physical fitness; Military Schools; Physical tests.

RESUMEN

Anualmente, se abren convocatorias para jóvenes aspirantes a las diferentes escuelas de formación militar; para ello, existen ciertos requisitos para la selección del personal más cualificado para el acceso a estas instituciones. Entre ellos, diversas exigencias relacionadas con la condición física. Se plantea como objetivo de la investigación determinar los niveles y diferencias de la condición física entre dos grupos independientes de aspirantes a pruebas de ingreso de una escuela militar ecuatoriana. El estudio es descriptivo-correlacional con enfoque cuantitativo, realizado en una población de (N=40) jóvenes aspirantes a una Escuela Educativa Militar con una similitud de condiciones. Estos se clasifican en dos grupos independientes con 20 integrantes cada una (LN: Liceo Naval; CNC: Colegio Nacional Conocoto). La condición física fue evaluada mediante tres pruebas del Ejercito Nacional del Ecuador. En función de correlacionar datos, se utilizó la prueba paramétrica t de Student para muestras independientes ($p \leq 0.05$) en los *test* de flexión y extensión de codo y cadera y el *test* de resistencia en 3219 m. Existieron diferencias significativas entre los dos grupos evaluados en cada *test* ($p=0.000$), los cuales fueron mejores las medias en el grupo de aspirantes LN frente al grupo CNC. Específicamente, el Liceo Naval presentó mejores indicadores de capacidad física y, en sentido general, se identificó una carencia de condición física por parte de los aspirantes de las dos escuelas independientes, caracterizados por bajos niveles de actividad física. Este aspecto que repercute negativamente en los resultados de las pruebas de ingreso a academias militares ecuatorianas.

Palabras clave: Jóvenes aspirantes**;** Condición física; Escuelas Militares; Pruebas físicas.

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RESUMO

A cada ano, há convites para inscrições de jovens candidatos às diversas escolas de treinamento militar, e há certos requisitos para a seleção do pessoal mais qualificado para o acesso a essas instituições. Estes incluem vários requisitos relacionados à condição física. O objetivo da pesquisa é determinar os níveis e diferenças nas condições físicas entre dois grupos independentes de candidatos a exames de admissão a uma escola militar equatoriana. O estudo é descritivo-correlacional com uma abordagem quantitativa, realizado em uma população de (N=40) jovens candidatos a uma Escola de Educação Militar com condições similares. Estes foram classificados em dois grupos independentes com 20 membros cada (LN: Liceo Naval; CNC: Colégio Nacional Conocoto). A aptidão física foi avaliada por meio de três testes do Exército Nacional do Equador. A fim de correlacionar os dados, o teste t de Student paramétrico para amostras independentes ($p \leq 0.05$) foi usado para os testes de flexão e extensão de cotovelo e quadril e o teste de resistência a 3219m. Houve diferenças significativas entre os dois grupos avaliados em cada teste ($p=0,000$), com o grupo candidato LN tendo melhores meios do que o grupo CNC. Especificamente, o Liceo Naval tinha melhores indicadores de capacidade física e, em um sentido geral, foi identificada uma falta de aptidão física nos candidatos das duas escolas independentes, caracterizada por baixos níveis de atividade física. Este aspecto tem um impacto negativo sobre os resultados dos exames de ingresso nas academias militares equatorianas.

Palavras-chave: Candidatos jovens; Condição física; Escolas militares; Testes físicos.

INTRODUCTION

Annually, calls are opened for young applicants to the different military training schools; for this, there are certain requirements, which need the selection of the most qualified personnel, in order to enter these institutions. Together and within the demands of the admission process, as a requirement, a series of physical, psychological, technical, medical and academic tests are carried out (Guevara, Morales, 2017; Clavijo, *et al.,* 2016) that according to the performance that are obtained in each of these, the applicant will be able to enter his military training.

One of the most worrying aspects on the part of the applicants is the Physical Fitness (CF in Spanish) tests. The CF is defined as a measure of the capacity of an individual to perform physical activity, which is part of the physiological functions of the organism, as well as the congruence of all the structures of the musculoskeletal system, (Morales, González, 2015; Martínez- Vizcaino, Sánchez-López, 2008). These are immersed in the movement of the body. Likewise, CF corresponds to the group of anatomical and physiological qualities that individuals develop in order to execute different physical demands. An adequate CF is related to an optimal congruence between the neural system and the skeletal muscle. These are characterized by rapid synchronization and recruitment of the different muscle groups, which improves reaction time; this acts accordingly and increases the power level and the general capacity of the person (Lyakh, *et al.,* 2014; Haff, Triplett, 2015; Clavijo, *et al.,* 2016).

For the military, CF is a key factor and a fundamental pillar of his operational work (Šimenko, *et al.,* 2019; Kassim, *et al.,* 2018). This factor can enhance the execution of displacements and movements, as well as reduce the energy expenditure of the activities carried out, for which they are indicators of analysis as a significant competence of

military physical preparation (Larrea, Morales, 2017; Rivadeneyra, *et al.,* 2017). This competence improves cardiovascular response capacity and minimizes risk factors that determine chronic non-communicable diseases. These tend to be equally important indicators for the armed forces professional (Maldonado, *et al.,* 2017). In this sense, various physical demands are required of applicants to military schools in all armies (Fajardo, 1994; Margolis, *et al.,* 2014; Maldonado, *et al.,* 2017). This efficacy and capacity depend mainly on their physical fitness and specific combat status (Everett, *et al.,* 2008; Maldonado, *et al.,* 2017).

CF can be measured using scales, sets and *tests* that have been previously designed for this purpose (Clavijo, *et al.,* 2016; Tipán, Morales, 2018). Many of the tests used to evaluate military applicants consist of *tests* to assess muscular and cardiorespiratory endurance (National Research Council, 2015). These two capacities are relevant in these population groups, since having an adequate development of muscular and cardiorespiratory endurance allows the performance of physical tasks that reduce the levels of fatigue required in the military field. In this way, the physical, theoretical-tactical and psychological stimuli that the military profession demands are responded to in excellent terms (Valverde, *et al.,* 2018; Larrea, Morales, 2017; Rivadeneyra, *et al.,* 2017).

The main problem that it raises in the applicants is the low levels of physical fitness that young Ecuadorians present in general; (Flowers *et al.,* 2014). This previous information is corroborated by the National Health and Nutrition Survey, which indicates that a large part of young people between 10 and 18 years of age are physically inactive; additionally, this survey shows more than a third of adolescents (specifically 34 %). These subjects fall into the category of inactive, 38.1 % are classified as irregularly active and less than three out of ten young people are considered active (Freire, *et al.,* 2015; Llerena, 2019).

In accordance with the above, there are aspects that each young applicant should not do without, since the performance in the evaluations of the applied physical fitness depends on these. Among these, it is highlighted that the participants, before taking these tests, maintain adequate levels of CF and perform regular moderate to vigorous physical activity. This originates from the fact that the military profession, as has been reiterated in previous paragraphs, presents constant physical demands (Villacres, Paredes, 2011). Therefore, those applicants to the Military Schools with low levels of CF due to the low and null performance of daily physical activity, will have difficulties when accessing a military institution.

It is essential that physical performance is evaluated through a CF diagnosis with the respective *tests* (Nieto, Cárcamo, 2016; Dada, *et al.,* 2017). This made it possible to identify the physical aptitudes of each of the students who aspire to enter military schools. In this way, it is determined at what level the physical capacities of these population groups are and it is known if the results are related to other researches carried out in these groups, framed in the national problem of young people. For all of the above, the objective of the study is to determine the levels and differences in physical fitness between two independent groups of applicants for entrance tests at an Ecuadorian military school.

MATERIALS AND METHODS

Quantitative approach study, descriptive-correlational and cross-sectional scope, carried out in a population of aspiring students from two different institutions. The sample is of a non-probabilistic type taken for the convenience of the researchers. A total of (N=40) male students aged between 17 and 18 years were taken into account, of which (N=20) belong to the Liceo Naval (LN) institution and (N=20) to the National College of Conocoto (CNC). Those who were authorized by signing the consent and assent, prior information to their parents, and their willingness to participate in this study were included in this study.

For the collection of information, permission was previously requested from the Ethics Committee of the University of the Armed Forces Espe and from the admissions department for applicants through a formal letter addressed. Once authorized, a meeting was held with the applicants where each of the objectives and procedures of the study were explained; Likewise, they were provided with informed consent and assent in the event that the applicants were minors for the respective completion.

The measurement was made in the morning hours, after a five-minute warm-up, in which the applicants showed an effort of 2 to 3 on the Borg scale. For the measurement of physical fitness, exercise science professionals previously trained in the application of the *tests* were used and the following tests were carried out, which are explained below:

1. Arm flexion test (plank position): the candidate is placed face down to carry out the movement, taking into consideration the arms at biacromial width, the arms extended and the feet together, here it is avoided to bend the legs so that the position of the body is completely horizontal with the back in a straight position and with the eyes to the front. For the execution, the arms must be flexed until the chest makes contact with the floor; a greater number of possible repetitions is performed in the established time of 1'30''. The test ends if the participant stops and cannot perform any additional repetitions.

2. Hip flexion test (abdominals): the participant lies on his back with the body fully supported on the ground and from a position of full extension. For the execution of the movement, it is begun with a simultaneous flexion of the hip and the knees, to later recover the initial position. In this way, they seek to perform the greatest number of repetitions in 1'30''.

3. Two miles test (aerobic endurance): the applicant starts from a previously established starting point and in a standing position to start the test, in which he must complete 3219 meters in the shortest possible time.

According to the previous *tests,* there is a respective Scale proposed by the National Army of Ecuador. This is a reflection of each of the minimum results, in each of the tests described in the previous paragraphs for young people aspiring to enter the Ecuadorian Military Schools. Both the arm flexion *test* and the hip flexion test, the minimum scores are expressed in repetitions and for the two-mile *test,* the scores are expressed in minutes and seconds (Table 1).

Table 1. - Minimum score for young people aspiring to Military Schools in the different tests

Table	Years	Arms flexion test		Hip flexion test		Two Mile Test	
		1'30"		1'30"		3219 meters	
		Men	Women	Men	Women	Men	Women
Only	18 -22	Four. Five	33	fifty	40	12´57"	15´52"
						18´57"	21´52"

Source: Ecuadorian National Army.

According to the Ministry of Public Health of Ecuador and the Regulation Development, Surveillance and Control of Clinical Trials, Ministerial Agreement no. 0075-2017, this study was classified as *Minimal Risk*. Ministry of Public Health. In this sense, because some of the participants were minors, the parents had to authorize the participation of their children by signing the informed consent. In this meeting, the objective of the study, the procedures that would be carried out, the voluntary participation and the confidentiality of the information were clearly informed. The participants were identified with codes in the analyzed database.

Statistic analysis

For the analysis of the data, the information was tabulated in Microsoft Excel 2019 and later transferred to the Statistical Software SPSS version 25. A descriptive analysis of the variables of interest of the study was carried out. For the results of the samples, independent of each one of the *tests,* the parametric Student `s t-test was used for independent samples ($p \leq 0.05$), since there was a normal distribution of the data according to the Shapiro-Wilk test.

RESULTS

In table 2, the means and the minimum and maximum values of the results of each of the tests carried out on the applicants of the two institutions can be identified. The arm and hip flexion *tests* were expressed in repetitions and the two-mile *test* was expressed in time (minutes) (Table 2).

Table 2. - Results of the different physical tests of the population

Characteristic	M	min	max
Elbow Flexion Test			
LN	25	twenty	30
CNC	twenty-one	fifteen	27
Total		30	fifteen
Hip Flexion Test			

LN	33	29	40
CNC	27	twenty-one	32
Total	30	twenty-one	40
2 Mile Test			
LN	17.6	15.18	20.59
CNC	20.9	17.12	25.01
Total	19	15.18	25.01

Note: M= average, Min= minimum value, Máx = maximum value, LN= Applicants of the Liceo Naval institution, CNC= applicants of the Colegio Nacional de Conocoto institution.

Existence of significant differences in all cases was determined by Student's t-test for independent samples. Here an identical bilateral asymptotic difference prevails for all three physical fitness *tests (p=0.000).* In the case of elbow flexion and extension, the differences favored the Escuela del Liceo Naval (LN), as there was a higher mean (25.15) than that established at the Colegio Nacional de Conocoto (CNC: 20.85). This is an indication of a greater number of flexion-extension movements in the first case.

On the other hand, in *the* hip flexion and extension test, also known as the sit-up test, the LN group also obtained a better mean (32.95) than the CNC school (27.30). This result presented better indicators of local muscle power. Likewise, in the case of the 3,219 m endurance *test,* the LN school presented better aerobic endurance, completing the test in a shorter average time (17.6475) than the CNC school (20.2925) (Table 3) and (Table 4).

Table 3. - Student `s t test for independent simples

Group statistics						
	Groups	N	Mean	Dev Deviation	Dev.	Error average
Ex- Flexion Elbow	Naval Lyceum	20	25.15	3,453		.772
	Conocoto National College	20	20.85	3,528		,789
Flexion-Ex trunk	Naval Lyceum	20	32.95	3,576		,800
	Conocoto National College	20	27.30	3,326		,744
Enduance 3219m	Naval Lyceum	20	17.6475	1.64821		.36855
	Conocoto National College	20	20,2925	2.09077		.46751

Table 4.- Independent samples test

	Levene's test for equality of variances		**t-test for equality of means**					
	F	Next.	you	gl	Next (2-sided)	Mean difference	Standard error difference	95% confidence interval of the difference
								lower Superior

Flexion-Ex Elbow	Equal variances are assumed	.007	.935	3,895	38	,000	4,300	1,104	2,065	6,535
	Equal variances are not assumed			3,895	37,982	,000	4,300	1,104	2,065	6,535
Flexion-Ex trunk	Equal variances are assumed	.016	.902	5,174	38	,000	5,650	1,092	3,439	7,861
	Equal variances are not assumed			5,174	37,803	,000	5,650	1,092	3,439	7,861
Endurance 3219m	Equal variances are assumed	,383	,540	-4,443	38	,000	-2.64500	.59531	-3.85015	-1.43985
	Equal variances are not assumed			-4,443	36,036	,000	-2.64500	.59531	-3.85231	-1.43769

DISCUSSION

The main objective of this study was to determine the differences in physical fitness between two groups of applicants for military school entrance exams. According to the results obtained after the analysis of the parametric tests, it was possible to identify that there are significant differences between the two independent groups evaluated with each of the *tests;* this means that the CF of the LN group is significantly higher than that of the CNC group in the arm flexion *test* (p=0.000), hip flexion test (p=0.000) and the two-mile test (p=0.000).

The Armed Forces of Ecuador, as an integral part of the evaluation of the aspiring professional, prioritize the evaluation of physical fitness as one of the fundamental dimensions for admission to military schools. This evidence, according to the regulations, that the dimensions are mandatory for the evaluation of the physical fitness of the members of the Armed Forces, (Fedeme, 2018). From this analysis, it is considered to evaluate the cardiopulmonary or aerobic endurance, the specific muscular endurance of the upper extremities and the central zone. These tests certify the applicant's CF for the tasks and activities that the profession demands (Valverde, *et al.,* 2018).

Based on the above, according to the results obtained by each of the two groups and with respect to the scales presented by the National Army of Ecuador (2021), the average scores of the applicants are low for admission to military schools. Regarding the average repetitions in the arm or elbow flexion tests, it was ≈25rep for the LN group and ≈21rep for the group of CNC candidates. In hip flexion, a mean of ≈33 and ≈27 repetitions for the LN and CNC groups, respectively. However, in the 2-mile *test,* only

the LN group meets the minimum requirements demanded by the Ecuadorian National Army. From this, the deficit in the previous physical preparation of the aspiring soldiers is demonstrated, according to the requirements presented by Comaco (2016).

In accordance with the results described, the previously mentioned problem of low levels of physical fitness in young people can be verified. This information is corroborated by the National Health and Nutrition Survey as specified by Freire, *et al.,* (2015) and Llerena, (2019). From this it follows that low levels of CF are directly proportional to a null or low performance of physical activity from an early age (Martínez-Vizcaíno, Sánchez-López, 2008). Consequently, admission to these military schools can be impaired, as evidenced in other cases such as those established in Guevara, Morales (2017), since CF is a fundamental factor to enter these institutions (Valverde *et al.,* 2018).

And although CF is not the only dimension that is evaluated, it is certainly described as the most relevant in relation to performance in these schools. It is shown that some authors state that adequate physical fitness is related to and predicts better academic and military performance (Depaula, 2012; Gualán, Rosales, 2020). In this way, Gualán, Rosales (2020) indicate that the physical tests and the respective performance in them can have a 12 % influence on the subsequent development of the applicant in the profession.

This study is relevant, since there is a considerable lack of previous research in the national military educational context. On the other hand, the physical fitness of aspiring soldiers in Ecuador reveals an evident limitation in the development of this study. This serves as an opportunity to identify new gaps in the literature and, consequently, new research in the military area. In addition, despite the strategies used in terms of literature search and development of the study, there are very few articles that included physical fitness and its relationship with military entrance and performance tests for the Ecuadorian environment. That is why this research can serve as a theoretical and methodological basis for conducting research directly related to the field of study.

CONCLUSION

It is concluded that there are significant differences between the two groups evaluated in each of the physical fitness tests determined by the military schools. From here, a lack of general physical fitness is also identified by the applicants of the two schools studied, characterized by low levels of physical activity, which has a negative impact on the results of the entrance tests.

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