SCIENCE INCREASING PERFORMANCE: DERMATOGLYPHICS, SOMATOTYPE AND BASIC PHYSICAL QUALITIES PROFILE OF BRAZILIAN MILITARY ATHLETES

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1 INTRODUCTION

The high level sport is supported in scientific bases that seek to unite genetic factors and phenotype, searching for better performances (Silva & Fernandes Filho, 2008).

The physical characteristics of high level athletes, as well as the hereditary qualities, the psychological disposals and the physiological bases, established as models, have great importance in the selection, planning and training of young talented athetles (Wang, 1989).

Genetics represent a modern science that can collaborate with sports election questions. It had as great propellant Gregor Johan Mendel (1822-1884), monge and Austrian biologist. For Fernandes Filho (2003) the "inheritance of the biological characters is related to certain laws, in such a way that, by knowing the genealogy of a couple, we will be able to foresee its descent".

Bouchard, Malina & Perussé (1997) places that the variability of human being represents a substratum of genetics, whom it aims to define relations with the sequence of DNA variation and genetics interaction, co-acting with life style factors and environment variables.

Nikitjuk (1979) presented researches that purported to discover morphologic and functional characteristics and that could relate with the hereditary succession and the eventual detention of sport talent.

Moskatova (1988), that already identified the relation between hereditary succession and speed of movements, found that different traces of speed are also fruit of different genetic conditions, even so its alterations are fruit of external actions. There are clear differences in the genetic conditions of speed movements characteristics of arms and legs, as well as left and right extremities; the level of the genetic condition of motor speed suffers alterations according to age. Thus, the level of significance of the specific genotype in the determination of the speed characteristics and its evidence of alteration, relatively limited under influence of the sports training, inspires the correlation of biological laws of development and potentiality for training of these motor traces.

According to Hebbelinck (1989), coaches use their own experience and intuition in the works of talent selection. The most trustworthy method would be the identification of the ideal type of an athlete for each sport modality, as predetermined profiles of confirmed athletes (Silva, Zary, Pinheiro-DaCunha, Martins et al., 2003). The athlete, with a physical type in accordance with the standards established for its sport, would have better conditions to develop other qualities (as physiological and psychological), necessary to the elite sport (Hebbelinck, 1989).

2 OBJECTIVE

The objective of the present study was to identify dermatoglyphics, somatotipe profile, as well as basic physical qualities of high level Brazilian military athletes from the modalities of Military Pentathlon, Modern Pentathlon, Fencing (foil) and Volleyball.

3 LITERATURE REVIEW

3.1 Fingerprints

As standard of genetic mark, there are the fingerprints, also known as dermatoglyphics. Its formation occurs between the third and sixth month of the fetal life and remains steady with aging,

hence the development after birth does not have any effect in fingerprint variability, except in some pathological conditions, bringing advantage over other physical or physiological measures in human beings (Chakraborty, 1991). In the Medicine, fingerprints have intrigued the humans, since the primitive era, and along years, it comes as subject of study for anatomists, physiologists, geneticists, anthropologists and doctors.

The majority of authors distinguishes three groups of fingerprints drawings: arch, loop and whorl. The drawings form constitutes a qualitative characteristic and the amount of lines (AL), the total ridge count (TRC) - the amount of cutaneous crests inside the drawing represents the quantitative characteristic. The evaluation of the intensity of drawings is done by checking the presence of deltas and it is calculated the called delta index – D10; arch (A)– the drawing without delta; loop (L)– the drawing with a delta; and whorl (W)– the drawing with two deltas, corresponding to an evaluation 0, 1 and 2 respectively. So, the maximum evaluation is 20 and the minimum, 0 (the somatory of deltas in the 10 fingers), resulting as the simplest drawing the arch and the most complicated the whorl (Gladkova, 1966).

The analysis and classification of fingerprints index, and of more than 80 somatic-functionaries indexes of Russian high level athletes, form five main clains (TABLE 1), that are distinguished by the different dominant functionary, as can be observed,the low intensity of drawings (D10) and low TRC is correlated to higher levels of manifestations of strengh and power, but with lower levels of coordination and resistance; and the opposite: the rise of D10 and TRC is correlated with the reinforcement of the dominants resistance and coordination. Maximum values of D10 and TRC are guided to the development of coordinating qualities of the organism (Nikitjuk et alli, 1989; Abramova et al., 1995). The lower levels of D10, increasing parcels of simple drawings (A, L), reduction of complicated drawings (W, WS drawing) and the increase of the TRC – fast and high powered sports. The high level of D10, absence of A, increasing of 50-90% of the parcel of W and TRC increasing mark sports and different groups: speed, resistance, games and fights. The modalities of strengh and speed are situated in the field of lower values of D10 and the TRC; the complex proprioception sports - in the field of high values; resistance sports occupy intermediate position. All modalities of games present the same tendency: the difficulties of game responsabilities, the magnifying of the field activity during a game is correlated to the complication of digital drawings, increase of D10 and AL, increase of the percentage of drawings incidence (W, WS drawing), with the reduction L and disappearance of A.

Tab. 1: Classification of fingerprints and somatic-functionaries index among high level Russian athletes (rowers, N=101)

Class	Fingerprints		Somatic – functionaries	
	D10	TRC	Minimum	Maximum
I	5.5	26.5	Strengh (absolute) Resistance Coordination	Strengh (relative)
II	9.0	47.7	Coordination	Strengh
III	11.6	126.4	Strengh (relative)	Strengh (absolute)
IV	13.1	134.2	Strengh (absolute)	Resistance Coordination
V	17.5	162.8	Strengh (relative)	Coordination

Font: Abramova et al. (1995); Dantas et al. (2004), adapted by the authors.

Thus, allied to physical qualities, fingerprints are the genetic marks that can serve as pointers of main parameters of endow and motor talents, differentiating not only the specific functional characteristics for each modality, but also the joust specialization required in each sport. Following, in TABLE 2, some information of national studies:

Tab. 2: National studies about high level sportsmen and begginers

Modality	Year	N	A	L	W	D10	TRC
Parachutists	2003	22	0	6,7±3,19	3,1±3,23	13,1±3,24	101±19,15
Swimming speed male	2003	15	0,2±0,56	7,5±1,96	2,3±1,88	12,1±1,96	106,7±25,81
Swimming speed female	2003	7	0,9±2,27	7,6±2,07	1,6±1,51	10,7±3,25	107,7±41,17
Militaries Physical Education	2003	25	1,8±2,27	5,9±2,64	2,3±2,31	10,4±4,62	84,0±47,72
Acrobatic trampoline male	2003	8	0,4±1,1	6,0±2,0	4,0±3,0	13,0±3,0	112,0±39,0
Karate	2003	14	0	4,6±1,87	5,4±2,35	15,4±4,08	159,7±24,08
Gymnastics female	2002	25	0,6±1,05	6,3±2,18	3,1±1,45	12,4±3,08	97,8±25,74
Triathlon male	2002	10	0,6±1,9	6,3±2,99	2,9±3,03	12,3±4,08	118,6±44,92
Hunters Air Force pilots	2002	34	0,3±0,0	6,4±2,45	3,4±2,55	13,1±2,90	129,4±32,10
Volleyball male	2000	22	0,7±0,29	6,5±2,94	3,4±2,97	13,4±3,11	125,0±39,12
Orienteering male	2003	8	0	5,0±2,78	5,0±2,78	15±2,78	143,3±20,32
Futsal male	2000	66	0,0±0,17	6,5±2,89	3,5±2,90	13,5±2,93	147,4±32,88
Futsal children	2003	12	0,6±1,24	6,5±2,15	2,8±2,44	12,2±3,43	98,9±21,13
Soccer	2003	48	0,58+1,3	6,9+2,7	2,56+2,7	12,0+3,2	99,17+35,5
Handball female	2003	18	2,6±1,51	6,5±1,93	1,0±1,43	8,0±2,37	90,0±36,31
Handball begginers	2003	32	0,2±0,74	7,0±2,67	2,8±2,77	12,6±3,05	94,6±25,08
Fencing foreigners male	2004	6	0,2±0,41	4,0±3,46	5,8±3,76	15,7±4,08	155,8±32,44
Fencing female	2005	8	1,0±1,0	7,0±1,0	2,0±3,0	11,0±4,34	80,5±37,15
Judo female	2004	28	0,6±1,1	6,3±2,7	3,2±3,0	12,6±3,6	109,1±34,4
Swimming resistance	2004	48	0,57±1,08	6,3±2,9	3,13±3,3	12,57±3,4	136,13+49,0

Font: Fernandes Filho (2003, apud Pinheiro-DaCunha & Fernandes Filho, 2004) adapted by the authors.

3.2 Somatotype

The somatotype is an instrument used to know and identify characteristics of the athletes, being an excellent aid to a talent discovery, and allows a continuous checking of body composition, during a competition season (International Society for the Advancement of Kinanthropometry, 2000).

The somatotype final classification is an expression of three numbers that indicates the observed physical aspect, as well as its classification, allowing, the direct comparison between two or more physical types.

According to Carter (2000), somatotype allows description and comparison between sportsmen in distinct levels, characterizes alterations of physical components in different phases of life and during the training and compares relative form of men and women, as an analysis of body image.

For a multicriteria sports election, it is necessary, not only to establish a somatotype for the sport in question, but, also, to determine desirable indexes in relation to physical capacities of the athletes.

3.2.1 Endomorphic component

Endomorphy indicates, as main characteristic of physical structure, the rounding of corporal curves. An obese is a good example of full endomorphy, therefore the muscular relief is practically not noticed. It appers as a large abdominal volume, short neck and squared shoulders (Carter & Heath, 1990).

3.2.2 Mesomorphic component

Among its main traces, there are distinguished the great apparent muscular relief, with predominant contours in the regions of the trapeze, deltoid and abdomen, as a more massive bone structure, mainly in forearm region. The presence of body fat is small, allowing a good visualization of the muscles. This is the type of body structure frequently found in athletes (Carter & Heath, 1990).

3.2.3 Ectomorphic component

This third component, indicative of thinness and fragility, can be identified by the body linearity, with discrete muscular volume and small amount of fat tissue (Carter & Heath, 1990).

3.3 Basic physical qualities

According to Tubino & Moreira (2003), the identification of qualities or physical valences is the first step to be made for the development of a physical preparation, also considered as a basic point for the desired success.

The athlete election, for the different sports, is based on the efficient capacity to decide motor tasks of character technical-tactical. This efficiency can be linked to characteristic of resistance, speed, flexibility and agility, allied to psychic factors and adjusted to somatotype (Fernandes Filho, 1997).

According to Marins & Giannichi (1998), after determining the physical qualities to be tested, it is necessary to choose tests with coefficients of validity, fidedignity and objectivity, so that the gotten results can express a trustworthy parameter.

Military and Modern Pentatlhon are sports of combined tests, that demand an athlete with a multiplicity of physical qualities, amongst can be detached: aerobic resistance, anaerobic resistance, explosive strengh, agility, speed, flexibility and coordination (Ferraz Filho, 2008; Rolim Filho, 2007).

For Águila, Aljoe & Ferrer (2002), Fencing presents as physical qualities, to be developed in a training process, since childhood until the adult age, coordination, speed, strengh, resistance and flexibility. Cortés & Calvo (2001) mentions that, inside basic physical qualities to be developed for a fencer, it is distinguished strengh, basically of legs, a special resistance because of the competitions characteristics, flexibility for the necessary amplitude of movements and the speed.

Zary & Fernandes Filho (2005) presents as imperative necessities to the excellent performance of a Volleyball athlete, the coordination, the explosive strengh and the presence of great stature, so that it is possible to remain in the high income.

In such a way, Fernandes Filho (2003) declares that, in the process of physical evaluation of a high level sportsman, the results obtained by tests are basic to develop a good program of development of physical qualities.

4 METHODOLOGY

4.1 Subjects

The sample was constituted by 37 military athletes, convoked to take part on Brazilian Military Sports Commission (CDMB) teams and participants of Conseil Internationale du Sport Militaire (CISM) Military World Championships. All sample is of the masculine gender, high sports level, voluntary, divided in four groups, being six military pentathletes (Mil P), seven modern pentathletes (Mod P), twelve foil fencers (F) and twelve Volleyball players (V).

4.2 Procedures

Initially, the subjects were informed about the objectives of the study and, after answering an anamnese, signed the assent term.

After that, it has been made recommendations to the regular procedures during data collection.

4.2.1 Fingerprint protocol (Dermatoglyphics)

The chosen protocol was Cummins & Midlo (1942). The collection of the fingerprints was carried through by using paper and *Impress* brand fingerprints cushion. After the collection, the preliminary data processing was given, which standard method is the following:

1) More common drawings in the hand fingers distal phalanges (FIGURE 1):

- Arch “A” - drawing without deltas (*Fig 1-a*);
- Loop “L” - drawing of a delta (*Fig 1-b*); and
- Whorl “W” - drawings of two deltas (*Fig 1-c*).

a- Arch (A)

b- Loop (L)

c- Whorl (W)

Fig. 1: Most common drawings of fingerprints

2) Amount of lines (AL) - the amount of lines of the skin crests, inside of the drawing, is counted, according to line that bind the delta to the center of the drawing, without taking in consideration the first one and the last line of crest.

Therefore, there were calculated the following basic fingerprints indexes:

- The amount of the drawings of different types for ten hand fingers;
- the AL in each hand finger;
- The summary intensity of the drawings, in the ten hand fingers, or the delta index, (D10), gotten by the addition of deltas of all drawings, in way that the "evaluation" of an A is always 0 (the delta absence), L is 1 (a delta) and W is 2 (two deltas), that is, $\Sigma L + 2 \Sigma W$;
- The total amount of the lines, in the ten hand fingers.

4.2.2 Somatotype

The measures of somatotype had been obtained by the method of Carter & Heath (1990).

For determination of the components (endomorphy, mesomorphy and ectomorphy) it was made the measurement of skinfolds - subscapular, tricipital and supraespinale - using *Cescorf* brand scientific compass. In the measurement of bone diameters biepicondilar of the humerus (elbow) biepicondilar of the femur (knee), used paquimeter *Cescorf* and for the perimeters of the arm and leg, the anthropometric ribbon *Sanny* brand. Body weight and height had been measured with the stadiometer *Filizola*.

Fig. 2: Somatotype evaluation

4.2.3 Basic physical qualities (physical tests)

The sample was submitted, in different days, to the following physical tests to the measurement of basic physical qualities, related to each group: speed - 50 meters launched running (Mil P, F); agility - Shuttle Run (Mil P, F); maximum aerobic power ($\dot{V}O_{2max}$) - Léger-Boucher (Mil P, Mod P) and ergoespirometry (F); and anaerobic resistance - 40 seconds running (Mil P, F).

5 ANALYSIS AND RESULTS DISCUSSION

The drawings of the fingerprints, its types of combination, D10, AL had been analyzed, as well as the TRC. The somatotype was evaluated in its three components of endomorphy, mesomorphy and ectomorphy. There were also observed the values reached in the physical tests elected to evaluate basic physical qualities of each sport.

It can be seen in TABLES 3, 4, 5 and 6 the average, minimum and maximum results, as well as the standard deviation of the sample characterization, fingerprints drawings, D10, TRC, somatotype and basic physical qualities.

Tab. 3: Sample characterization by sport groups (Mil P, Mod P, F and V)

		N	μ	Minimum	Maximum	σ
Age (years)	Mil P	6	35.33	31	43	4.93
	Mod P	7	26.33	23	31	3.31
	F	12	22.3	18	28	4.03
	V	12	28.67	23.2	34.6	3.55
Body mass (kg)	Mil P	6	72.28	62.9	82.8	8.16
	Mod P	7	73.4	62.4	77.0	7.67
	F	12	70.6	57.10	81.70	6.69
	V	12	86.83	78.7	93.8	5,59
Stature (cm)	Mil P	6	174.92	166	181	5.41
	Mod P	7	180.33	170	185	4.54
	F	12	179.4	173.5	188	4.01
	V	12	194.67	183.5	204	6.64

For the analysis of the fingerprints results, constant of TABLE 4, is perceived that in the group Mil P there is predominance of digital drawing L, moderate indexes of D10 and the TRC, located between levels II and III of the classification of dermatoglyphics and somatic-functionaries indexes, proposal for Abramova et al. (1995). The physical qualities of strengh, speed, power and static stability, symptomatic in sports of high power and short time of duration, are perceived by the type of digital drawing and the amount of lines. However, coordenative characteristics and of relative strengh could berevealed less developed, in case that they have not been stimulated in the adjusted phases of the motor development, by means of the accomplishment of specific training.

In the group Mod P, the average of dermatoglyphic characteristics related to the digital drawings indicate the predominance of L and W. It is also perceived the reduction of the drawing A. In accordance with TABLE 4, the variable characteristic of the fingerprints had presented D10 with average value 14.1 and TRC of 128.6, that suggests high somatic-functional levels of coordination and resistance of speed.

In group F, concerning the TRC, it had similarity to the Russian athletes of Ski and Karate (Abramova et al., 1995), Brazilian Volleyball athletes (Medina & Fernandes Filho, 2002) and triathletes (Anjos et al., 2003). For the D10, the values had been similar to the skiers, biathletes, road cyclers (Abramova et al., 1995) and fast swimmers, triathletes, soccer players and futsal infantile category and handballers, all Brazilians.

The values found in group V corroborate with the affirmation of Abramova, Nikitina and Ozolin (1995), in which the absence of A and the increase of the parcel of W characterize modalities of strengh and coordination, being fit in Class IV.

Tab. 4: Dermatoglyphics results by sport group (Mil P, Mod P, F and V).

		N	μ	Mínimo	Máximo	σ
Arch (A)	Mil P	6	1.33	0	4	4.93
	Mod P	7	0.04	0	3	1.13
	F	12	0.8	0	6	1.99
	V	12				
Loop (L)	Mil P	6	7.6	5	10	1.52
	Mod P	7	5.0	1	9	2.45
	F	12	5.8	0	10	3.05
	V	12				
Whorl	Mil P	6	0.67	0	1	0.67
	Mod P	7	4.6	1	9	2.88

(W)	F	12	3.4	0	10	3.4
	V	12	3.83	4	10	2.44
	Mil P	6	9.2	6	11	2.17
D10	Mod P	7	14.1	8	19	3.63
	F	12	12.6	4	20	4.66
	V	12	13.5	9	20	2.88
	Mil P	6	82.3	20	143	42.34
TRC	Mod P	7	128.6	62	149	30.42
	F	12	119.9	39	192	46.98
	V	12	132.08	95	197	38.27

In TABLE 5, the somatotype results are detailed. It is observed that group Mil P presented 1,52-4,63-2,20, being characterized as mesoectomorphic. In relation to other sports, for not existing other results about Military Pentatlhon, it can be compared Track and Field athletes of speed - 100 and 200 meters, and with the ones of Decathlon, that possesss the same characteristics of the Military Pentatlhon, since it is a sport of combined tests.

In the group Mod P it is observed that the subjects of the study present, as somatotype profile, also the mesoectomorphic classification, with average 2,3-4,5-3,4, where the mesomorphism is dominant, and ectomorphism has higher values than endomorphism.

The components of group F presented as values of somatotype 2,5-4,0-3,3, that, one time more, characterizes the sample as mesoectomorphic. Concerning other studies, the gotten result reveals the same classification in foreign foil fencers done by Rodríguez et al. (1986, apud Carter & Heath, 1990), inferiors levels of endomorphy and mesomorphy and superiors of ectomorphy, according to Eiben (1980, apud Carter & Heath, 1990).

In group V, it is perceived predominance of mesomorphy in relation to ectomorphy, fact proven by the biggest development muscle skeletal. These results coincide with the joined by Carter & Heath (1990), that is, the majority of Volleyball athletes is ectomesomorphic, having differentiation in some countries, in which they tend for the mesomorphy, other times to ectomorphy. In all the cases, mesomorphy and ectomorphy are the highest components.

Tab. 5: Evaluation of somatotype, following sport groups (Mil P, Mod P, F and V).

		N	**μ**	**Minimum**	**Maximum**	**σ**
	Mil P	6	1.52	1.32	1.69	0.13
Endomorphy	Mod P	7	2.3	1.75	2.65	0.47
	F	12	2.5	1.7	4.3	0.94
	V	12	2.6	1.8	3.1	0.69
	Mil P	6	4.63	1.48	5.55	1.03
Mesomorphy	Mod P	7	4.5	1.56	4.85	0.95
	F	12	4.0	2.3	5.1	0.91
	V	12	4.2	2.8	5.6	1.69
	Mil P	6	3.08	2.2	6.88	0.57
Ectomorphy	Mod P	7	3.4	2.15	5.45	0.68
	F	12	3.3	2.2	5.5	0.95
	V	12	2.6	2.2	5.8	0.86

The sample somatotype distribution can be easier observed on the somatocharts of the groups, on the following FIGURE 3:

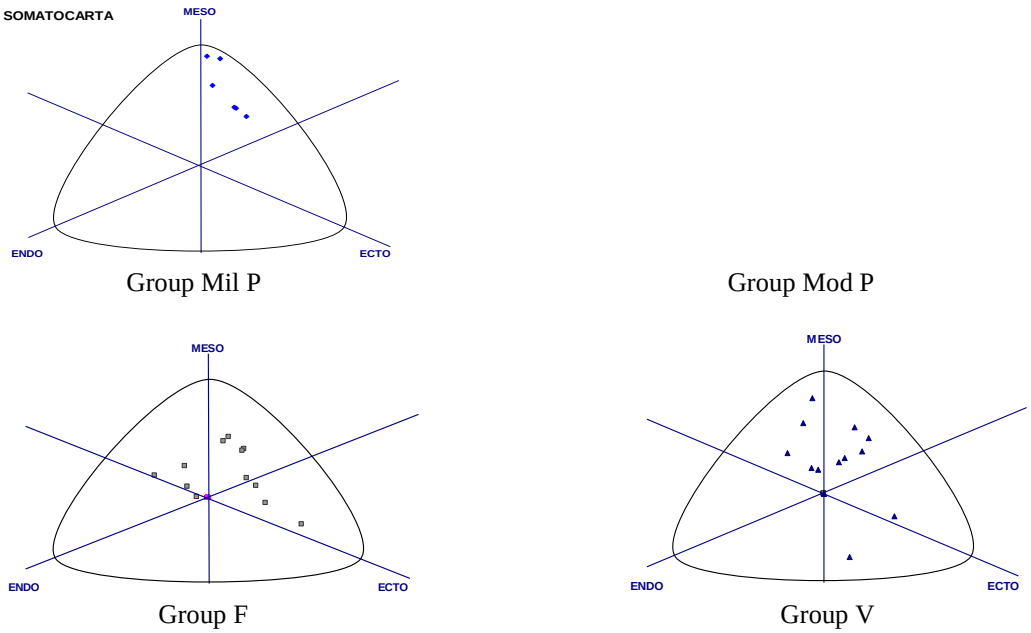

Fig. 3: Somatocharts

About the basic physical qualities, the average value of the $\dot{V}O_{2max}$ of the group Mil P demonstrates a very aerobic resistance. In relation to the result of the anaerobic resistance (296,5 ± 4,04 m), they presented similar values to Track and Field athletes (295,90 ± 17,70 m). About agility, the results had presented values close to Futsal players.

The group Mod P had presented average value of $\dot{V}O_{2max}$ intermediate in relation to the groups Mil P and and F [50,7 ml(kg.min)$^{-1}$], being this fact justified by the specific characteristics of each modality.

Group V could not be evaluated because of the training phase, that was presented next to competitions, in order to prevent any interference in the planning of the activities and in its physical preparation.

There had not been found, in searched literature, results of tests of the other physical qualities, for a similar sample, so that can be done the pertinent comparison. However, the values detached are basic for the accomplishment of future comparisons.

Tab. 6: Physical tests results (basic physical qualities), following the sport group (Mil P, Mod P and F)

		N	μ	Minimum	Maximum	σ
Speed (sec)	Mil P	6	5.81	5.51	6.15	0.24
50 m lauched	F	12	6.3	5.42	7.42	0.54
Agility (sec)	Mil P	6	9.03	8.80	9.25	0.17
Shuttle Run	F	12	9.9	8.84	11.18	0.72
$\dot{V}O_{2max}$ [ml(kg.min)$^{-1}$]	Mil P	6	66.47	62.5	70.5	3.25
Legér-Boucher and	Mod P	7	58.55	51.7	63.6	2.87
Ergoespirometry	F	12	50.7	45.7	54.7	3.53
Anaerobic resistance (m)	Mil P	6	296.5	292	303	4.04
40 seconds running	F	12	263.3	225	290	18.72

6 CONCLUSION E RECOMMENDATIONS

This research endeavoured, by means of qualitative and quantitative indexes, represented by fingerprints, anthropometric characteristics evidenced by somatotype and for the values of basic physical qualities, to describe the profile of the Brazilian military teams of Military Pentathlon, Modern Pentathlon, Fencing and Volleyball, raising data of informative marks, objective and of orientation of sport election.

Of course, the values found in the applied tests to evaluate the basic physical qualities can not translate the performance presented in a competition. Such affirmation is justified in the impossibility of evaluating the desired physical quality and the applied motor gesture in tests, the concentration level, the emotional state of the athletes, amongst other factors during the competitions.

The identification of the ideal profile of an athlete still requires other subsidies as psychological characteristic, or the inquiry of the behavior for the complementation of these results. It is known, however, that the information presented here represent only a small contribution, which concerns the knowledge of the characteristics of the practitioners of these modalities, not having, however, to restrict only the future studies in this area, but to be used so that they make possible tools for research in the most diverse sports.

It is expected that this research contributes with the scientificity in the election, orientation, detention of talents and physical preparation more and ajusted individualized, allowing the development of the analyzed sports, on the part of coaches, athletes and studious, as a ampler and including knowledge of the modalities.

As main and final recommendation, attempt this study to allow that this same population can be compared, in other chances, with other national and international teams, and/or serves as an subsidy concrete of the formation of the high level athlete and renewal of the values, knowing that the sport performance is a complex phenomenon to be studied and conceptually it must be dealt with distinct form inside of the areas of study and research of Sport Sciences.

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