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Morphotypology of Algerian handball players, members of the national team.

SOKHAL BOUKHARI Saliha[1], MIMOUNI Nabila[2], ZAKI Saliha[3]

[1]Laboratoire de Technologie et de l''Entrainement, ES/STS. Alger, [2,3]Laboratoire des Sciences Biologiques adaptées au Sport, ES/STS, Alger,
[1]salihaboukhari8@gmail.com , [2] nmimou@live.fr , [3] zakisaliha@yahoo.fr

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Auteur correspondant : Mimouni Nabila
Email: nmimou@live.fr

Abstract The aim of this study is to determine the morphotypology of Algerian handball players who are members of the national team. We investigated 15 male athletes, aged 22 to 32 years and practicing a regular training from 5 to 20 years with more than 500 hours per year.

We used the anthropometric method to select the most important morphological parameters in order to propose them for future selection.

Principal component analysis allowed us to approach the problem of sports morphology through statistics. We found that this analysis effectively highlights the fact that by simultaneously considering several morphological characteristics, it is possible to determine the "typical profile" of a given sport and to discriminate between the playing positions that we studied

Introduction:

The athlete's morphology may considerably influence his sport results. Researches on the morphology of an athlete have early been developed since 1951, especially through the works of Telkka, Pere and Kunnas. These works are generally descriptive, usually with a general aspect only. The obtained data are rarely analysed according to the specific activity of the athlete or according to the precise tasks defined to him. Lakomy (1978) developed some studies in this context on the Polish handball players. We mention also the works of A.B. Dufour et al (1987); J.C. Pineau (1992) on the morphotypology of the French handball players and on the study of Jeschke (1995) on the handball players who participated to the world championship in 1995. Several studies dealing with the athlete's morphology tend to show the impact of this factor on performance. It seems that at the international level, the players have achieved such performance in practise that it becomes difficult for them to progress individually. This training allows players to achieve a high level of performance and the most appropriated morphology will constitute the determined factor.

In relation to that, several researches (Tonmanian and Martivossov, 1976, Koslov et al, 1977; Boulgakova, 1978; Heyters, 1984; Claessens et al, 1978) allowed to establish the standard characteristics of the model sportsman, of the elite athlete in order to select athletes practising such or such discipline. Then, a statistical analysis of the morphological characteristics of the sportsmen samples, divided according to their sex, age, specialization, level etc., may establish the morphological references of the sampled different human groups. In fact, the understanding of the best morphotypology allows to raise the training level and to improve the technical results.

All these informations lead us asking about the morphology of the Algerian athletes of high performance and more particularly about handball players, members of national teams. There is a few data on the Algerian athletes morphotypology (Mimouni, 1996), and the knowledge of such a morphology can be a tool or a help to the coaches decision.

On the frame work of the present research , we present a study of a limited number of characters observable on handball players, and we limit ourselves

to some measurable morphological characters (or metric morphological characters).

The study of such metric morphological characters is the somatometry. This is a part of the anthropometry : a more general term which includes bares measurements study (osteometry) and alive body's measurement (somatometry) at the same time. The terms of somatometry and anthropometry are often considered as equivalent in practise.

Methodology :

1 : Sample :

We realized our investgation on a sample of 15 Algerian athletes, all adults, male gender, practising high level competitions (national and international, continental and intercontinental ones) and all of them are members of national teams.

These athletes aged from 22 to 32 years old, have been practising a regular physical training since 5 to 20 years in national team, with an annual volume of at least 500 hours.

Table 1 : Total parameters of Algerian handball players.

Age	Weight	Height
26.29	86.07	186.26
1.41	3.54	2.40
10.22	47.07	29.14

Anthropometric techniques are used to carry out measurements which are based on anthropometric points that are easily identified thanks to various reference points (bone, skin folds or specific elements) standardized by MARTIN R. (1928), then by ROSS et al. (1982).

The dimensions and measurement points in our experiment are as follows:

-Longitudinal measurements or body lengths

- Transverse measurements or body diameters
- Circumferences of body segments (perimeters)
- Skin folds

We also calculated body composition.

The main instruments used in our research are the following
An anthropometric kit of the G.P.M (Siber-Hegner) type containing :
-An anthropometer of the "MARTIN" type: Intended to measure the linear (longitudinal) and transverse dimensions of the body.
-A compas used to measure small diameters, i.e. the distance between two points
-A caliper: For the measurement of adipose pani-cules with an accuracy of 10 g/mm².
-A steel tape: We use it to measure body perimeters (circumferences) and segments.
-The "SECA" type medical scale: Used for weighing with a precision of 50gr.

2. Results :

A first statistical and descriptive analysis, concerning 41 anthropometric characters, allowed us to classify them in four big groups of characters, such as anthropometric points which will help us to calculate lengths, diameters for widths estimation, perimeters which inform us about the state of development of the muscle structure and the skin folds which enable us to evaluate the greasy component .

2.1. Lengths :

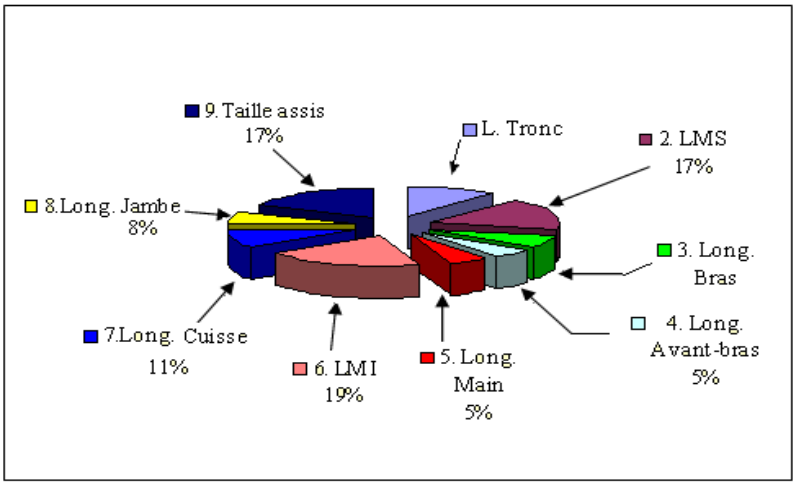

Fig. 1 : Représentation des longueurs (en pourcentage) des handballeurs algériens.

Fig 1 : Lenghts of algerian handball players in percent

In the lengths analysis, the Algerian athletes of national team have long “legs” (lower limbs) and present similar lengths concerning forearm and the hand.

2.2 Diameters (cm) :

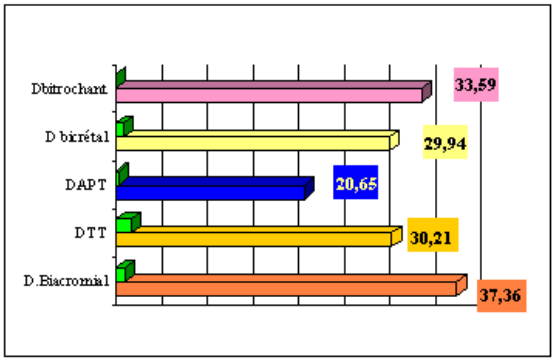

Fig 2 : Representation of algerian handball players widths

The diameters analysis inform us about the body's width. We notice that our athletes are characterized by an important diameter in pelvis.

2.3 Circumferences (cm) :

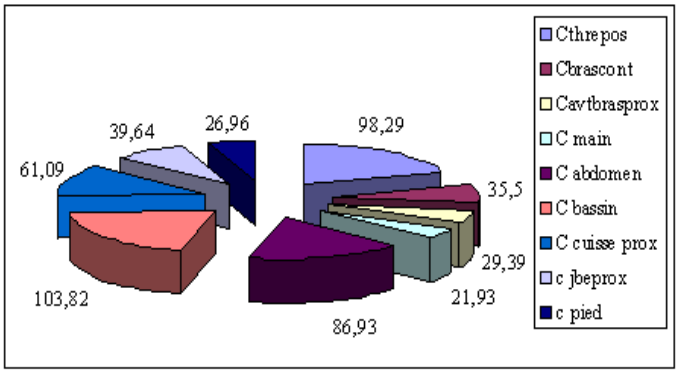

Fig. 3 : Representation of Algerian handball players circumferences

The thorax circumference is lower than the pelvis one. This character must be taken into consideration for the future selections.

2.4 Skinfolds:

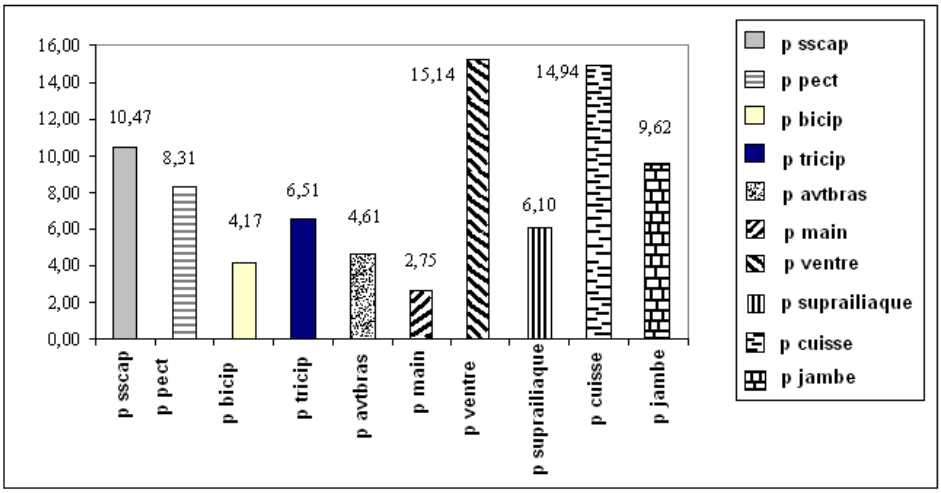

Fig. 4 : Representation of skinfolds in Algerian handball players

Our athletes present high values of adiposity at both stomach and thigh, that's why we suppose that the training level is not high ; indeed our national team was in a training preparatory period during our investigations.

2.5 Physical development indexes

We have also calculated a certain number of physical development indexes in order to estimate the morphology of the handball player, that's why we have calculated Quetelet indexes P/T^2, (gr/cm^2); P/T (gr/cm); the absolute area according to Dubois ($S=m^2$), the energy expenditure index (S/P ; cm^2/kg), the brachial index (LAB/LB, length of arm/length of forearm) and the acromio-iliac index (DBC/DBA, biacromial width/bicretal width).

Table n°2 : Physical development indexes

Indexes	P/T	P/T2	S=M2	S/P	Skèle index	LAB/LB	DBC/DBA
Mean	462,08	24,83	2,12	247,40	116,80	72,86	80,19
SD	13,10	0,39	0,06	3,55	2,33	4,70	0,01
Variance	1178,67	3,98	0,01	122,06	17,83	92,67	22,07

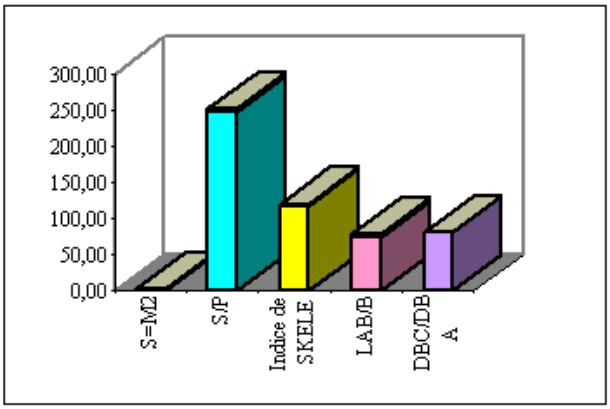

Fig. 5 : Representation of physical development indexes

Our athletes are macroskeles, (according to the scale established by Manouvrier), they present a good index of robustness, an average acromio-iliac and brachial index.

2.6 Body composition

To determine the body composition, we have used Mateika's (1921) calculation methods.

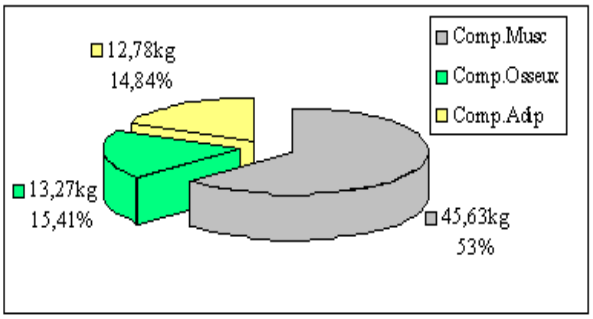

Fig. 6 : Body composition of Algerian handball players

Algerian handball players have a good body composition, with a well-developed muscle component and a low fat component. These values characterise top athletes.

3. Principal Component Analysis :

The third part concerns the principal component analysis of the 41 measured characteristics, which will allow us to eliminate redundancies and keep only the characteristics specific to this population of handball players. For our calculations, we used the MVSTAT.02 software, developed by J. Pontier et al (1992).

The principal component analysis (PCA) allows us to highlight the redundancies between the characters, thus favouring the selection of the most representative characters, among a group of measures of the same nature, of the morphology of the Algerian handball player. We performed PCA on the different groups of measures, that enabled us to select ten characters. We also represented our sample in a factorial map in order to better identify the morphotypology of the athletes according to the correlations of morphological characteristics (Benyelles and al. 2017).

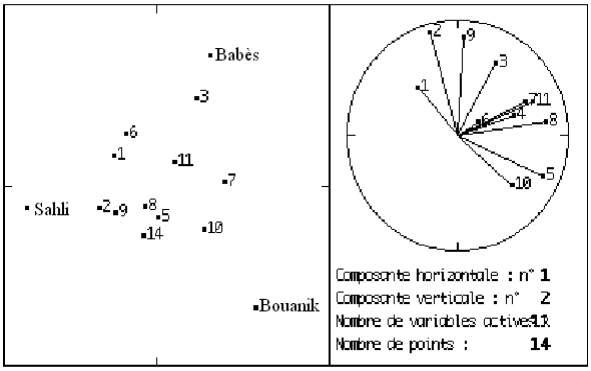

Fig 7 : Factoriel chart of algerian handball players

We can easily notice on the right, the factorial chart of the Algerian handball players, members of the national team, and on the left the circle of correlations representing the diameters in the plane of components 1 in horizontal and 2 in vertical.

At the end of the analysis on these different measurements, we selected 10 morphological characters, of various natures (lengths, diameters, components of the body weight), as well as an index of robustness (Quetelet), the index of skele and the span. The selection of these traits and indexes was made from a larger number of morphological parameters, taking into account the specificity of the sport practiced. The profile of the Algerian handball player can be constituted by the list of values of these measured variables (Berbagui, 2022).

The purpose of this selection is to see if the variables thus chosen represent the handball player in general and by playing position in particular. In other words, in relation to the profile defined by these 10 variables, are the individuals belonging to the same group similar to each other, or do they differ according to the position they play in? If the answer to this question is yes, then for each position we can match a kind of "average profile" or "standard profile", from which the group members will not deviate too much, and such that the average profiles of two different groups will themselves be

different. Such standard profiles can therefore be used to characterise the playing positions, based on the list of 10 selected characters.

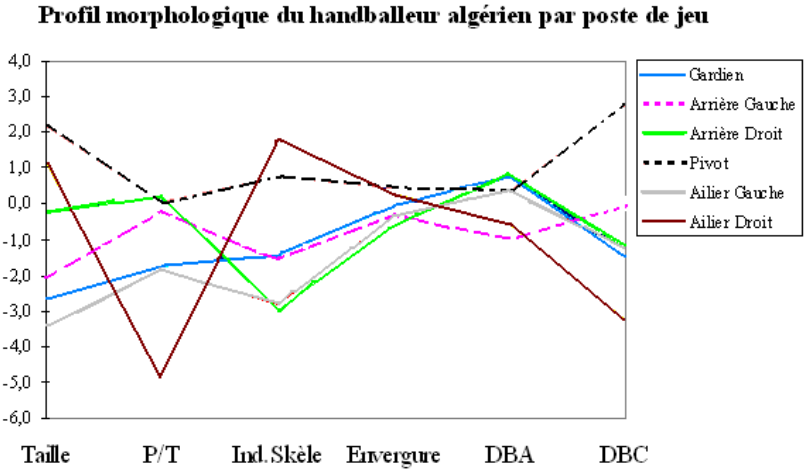

Fig 8 : Morphological profile of Algerian handball player by playing position

4. CONCLUSION

The Principal Component Analysis has enabled us to approach the problem of sports morphotypology through statistics. We have noted that this analysis effectively highlights the fact that, by simultaneously considering several morphological characteristics, it is possible to determine the "typical profile" of a given sport and to discriminate between the playing positions that we have studied.

On a practical level, our work has therefore at least demonstrated that it is possible to associate a typical profile with each sport discipline, which truly characterises it, providing that we accept that this profile is based on a relatively large number of morphological characteristics. Although our study only involved fifteen handball players, its implementation on a much larger number does not pose any theoretical problem, but only a practical one : of sampling and measurement campaign. We would like to use our

present experience to participate in the construction of such an "extended" morphotypology, which can only be the result of teamwork.
The subsequent concrete use of such a morphotypology (either our typology restricted to handball, or a typology extended to a large number of disciplines) can be conceived as consisting of two phases:

- in the first phase, the practice of individual measurements are followed by comparisons with standard values (to appreciate the extreme character or not of the observed values); indeed, this first phase leads to the establishment of the individual profile .

- in the second phase, we have the comparison of the individual profile thus constructed from the measurements with the standard profiles associated with the various disciplines. The direct outcome of this second phase is the evaluation of the existing gap between the individual and the standard profile of each discipline concerned.

From this point on, the role of this morphotypology as a tool stops, leaving room for the use that the user intends to make of its results: referral to the closest discipline, to the most suitable position, definition of a training process, monitoring of the possible evolution of an individual profile over time, and research into the interpretation of this evolution, carrying out detailed statistical studies on individual deviations from the standard profile, etc.

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