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Research Article

Somatotypic Cartography of Javelin Throwers in Algeria, Men and Women -

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ABSTRACT

The study aims at identifying the morphological profile and determining the physical qualities of the javelin throwers in Algeria men and women. For this purpose, we assumed that the Algerian throwers possess physical qualities that allow them to throw the javelin farthest and have an acceptable template to achieve good performances in javelin throwing.

And to verify these hypotheses, the study based on a descriptive method took place with a sample composed of 07 throwers and 07 throwers finalist of the Algerian OPEN championship for the year 2014; these two groups were subjected to physical tests and anthropometric measurements for this purpose. The results obtained show that our throwers have considerable physical qualities to be among the best throwers, they also have a morphological profile of mesomorphic type, but they throw not far, which invalidates our hypotheses. We conclude that Algerian launchers have acceptable physical qualities and a morphological profile of the mesomorphic type, and despite the presence of all the favorable conditions to achieve African and world performances, they still do not launch far. On this basis, we recommend that the actors of this discipline conduct a global expertise on the training contents, the recycling of trainers, the specific equipment and the infrastructure.

Keywords: Somatotypi; Cartography; Javelin throwers

ABBREVIATIONS

MM: Muscular Mass; MO: Bone Mass; MG: Fat Mass; BMI: Body Mass Index; SA: Body Surface Area

INTRODUCTION

The development of physical qualities is a transversal concern that interests and questions the majority of technical executives in high-level sport. The training processes implemented for this purpose are based on preparation models resulting from decades of practical experience, scientific developments in this technology.

The pursuit of athletic performance has aroused the interest of several countries, especially the most powerful, since between the two worlds wars. The constant rise in the level of performance has led to a very strong rationalization of training and selection of athletes.

To this end, several studies have been carried out in order to identify the main factors that act on the performance of athletes. Some scientists have taken a strong interest in this objective and have tried to study and identify the different factors acting on sports performance, thousands of reports and periodical articles appeared between the 1950s and 1970s, the majority of this work according to Bouchard C [1] concerned all sports disciplines (general factors) which were embodied in models of the factors of physical value and not models of the determinants of sports performance, other researchers have tried to '' develop a general theoretical model or specific to a sports discipline, distinguishing between the different factors that may be associated with sports success. These models were and still remain an important reference for certain countries in order to structure their elitist sports policy and with the aim of increasing their chance of collecting the maximum number of medals at major international sporting events. The improvement of sports results has long been conditioned by the rationalization of the preparation process, obeying the respect of the multifaceted development of the athlete by the construction of specific skills which will be the basis of all learning.

The interest shown by several authors in the physical qualities and morphology of top-level sport clearly shows the importance of these factors as components of performance [2-4]. According to Platonov [5], the level reached by performances no longer makes them accessible, only to individuals endowed with rare morphological qualities, associated with a very high level of development of functional and mental capacities. Body composition corresponds to the analysis of the human body in compartments [6]. The influence of the practice of a sporting activity on an individual's body composition has been the subject of several studies and has been demonstrated in several studies [7-10], muscle factors associated with performance in launching exploration through the analysis of force-speed and power-speed relationships. In athletics, studies focusing specifically on the morphology of throwers [11-14], clearly show the great importance of a specific morphology in each throwing specialty, for achieving a high level of performance. Anthropometric research applied to sports, carried out by the medical profession is relatively numerous. Descriptive in nature, they most often seek to establish morphological profiles by sport specialty with a view to evaluating athletes [15]. However, the problem of the relationship between morphology and the specific tasks linked to each sport is rarely analyzed.

It is in response to this type of work that we sought a link between physical and morphological qualities and action, performance on the field among Algerian javelin throwers. The detection of a good morpho functional condition is a premise for a better efficiency of the mechanical performance with a good development of the physical qualities. It offers a certain guarantee for the attainment of high performance. The Somatotype determination is thus an important starting point for selecting the most appropriate sport for each subject [16]. It is of great importance for medical and physical anthropology as well as sport science [17].

The morphological aptitudes is less important in disciplines where multiple factors from different fields intervene, particularly the technical-tactical and strategic aspect as well as the psychological or relational aspect. Morphological data are rarely analysed according to the specific tasks of each sport. Indeed, the national records are insignificant compared to the international records. Thus, the Algerian throwers could not qualify or participate in a final international competitions during the history of the event.

In view of these results, the following question may be asked: Do Algerian throwers have the acceptable physical qualities and morphological profile to throw the javelin as far as possible?

To answer this question we propose the following hypotheses:

- Algerian throwers have considerable physical qualities to be more efficient.
- Algerian throwers have a morphological profile that favours good results.
- Algerian throwers possess physical qualities and a morphological profile suitable for better performance in javelin throwing.

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Through this work, we will try to evaluate the physical qualities and to determine the morphological profile of Algerian men and women throwers, senior category on a somatotypical map of men and women throwers according to the Heath-Carter method. All these figures highlight the gap that separates the Algerian men's and women's javelin from the African and world levels of the specialty. The influence of the practice of a sport activity on an individual's body composition has been the subject of several studies. The analysis of biomechanical parameters in the different disciplines of launching has been the subject of several studies [18-21].

The interest of several authors in the physical qualities and morphology of high performance sport clearly shows the importance of these factors as components of performance [2-5], the level reached by performances only makes them accessible to individuals endowed with rare morphological qualities, associated with a very high level of development of functional and mental capacities. Body composition corresponds to the analysis of the human body in compartments [6].

MATERIALS AND METHODS

The purpose of this research is to verify the hypotheses mentioned above with a population of the best Algerian men and women throwers, given the importance of the subject which still remains unexploited in Algeria and especially in the field of the somatotype of the throwers, this analysis aims to carry out not only in order to bring a general aspect on the less good results of our throwers and their physical and morphological qualities but also the somatotypic determination of the javelin throwers we have chosen a descriptive study and the participants wore shuttlecocks for this study and with the consent of their coaches.

Participants

Fourteen (14) subjects participated in this study the population studied is composed of seven (07) men and seven (07) women. the study was carried out on a sample of 14 athletes representing the best Algerian senior throwers who have achieved the best national performances of the sports season 2014 (Algerian championship "OPEN").The sample selection mechanism is voluntary for this research.

Materials

Measurements and physical tests were carried out on site (athletics track, football fields).We proceeded with the following methodology:

Anthropometric body measurements and physical tests:

Age, stature, weight, span, (12 measurements) for diameters and (14 measurements) for circumferences and (10 measurements) for skin folds of the body.

Design and procedure- physical tests:

The six physical tests selected have the characteristic of being valid field tests, faithful and commonly used in this type of study. Moreover, the simplicity of administering the procedures makes it easy for interested sports circles to reproduce the procedures and compare their results with those of the present study. We chose the following tests:

50-metre Running Test, Shuttle Running Coordination Test (10x5 m), Football Throwing Test with two hands, Vertical Relaxation Test (Sargent Test), Flexibility Test. Five Jump Test.

Subjects therefore have the same level of training at the time of evaluation. Subjects were asked not to do any weight training on the day before the tests were conducted.

For the evaluation of the different components of body mass (muscle mass, fat mass), we used in our study the formulas proposed by MateigkaJ [22] and which are as follows:

Muscle mass, expressed in kilograms, according to the following formula:

$MM = KxHxR^2$

Where MM: muscle mass in Kg.

H: height in centimetres.

R: value of expression:Design and Procedure

R= [(circumferences: arm, forearm, thigh and leg Σ)- [(Σskin folds: arm, forearm, thigh and leg)

2,4x3,14 2,4x1 0

K= 6.5 constant.

- Bone mass, expressed in kilograms, according to the following formula:

$MO = 1.2 \times H \times O^2$

Where MO: bone mass in kg.

H: height in cm;

O: the value in cm of the expression

O= (Σ distal diameters: arm, forearm, thigh and leg) / 4

Sa: surface area of the absolute body, expressed in m^2, according to the following formula [23].

Sa = 1+ ([B + (H - 160)] /100)

Where Sa: absolute body surface area expressed in m^2.B: body weight in Kg. / H: size or stature in cm.

During the realization of our measurements, the main instruments used are the following:

- An anthropometric suitcase, containing: an anthropometry, a compass and a linen tape measure.
- Pleat pliers. - A medical scale.
- Investigation method: Anthropometric method: Basic anthropometric techniques were used to make the measurements and allowed the following parameters to be determined:
- Body weight (kg), as determined by the medical scale;
- -The distal diameters (cm) of the arm, forearm, thigh and leg, measured using the calliper.
- Circumferences (cm) of the arm, forearm, thigh and leg, determined using the tape measure.
- The skin folds (mm) bicipital, tricipital, sub scapular, belly, thigh and leg, measured using the fold clamp.
- Instruments for physical tests:
- A stopwatch to take the time, - A wall calibrated to measure vertical expansion, - A double decameter for distance measurements,

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- A regulation soccer ball in to measure the explosive force of the upper train. - A soft pit for the quintuple jump.
- Chalk to materialize the marks. - A rake to level the sand.
- A record sheet to record the results. - Bending of the trunk.

The measurements must all be taken below the bench as in our male subjects. To carry out our work, we made anthropometric measurements according to the basic anthropometric techniques laid down at the Monaco Congress of 1912. Overall body dimensions: consists of the measurement of weight and height. Bone diameters and muscle circumferences: in general, when a physical trainer takes the bone diameters and muscle circumferences, he measures the elbow and knee diameter with the help of anthropometry and takes into account the circumference of the arm (at the biceps) and calf with a measuring tape. This is done on the right side of the limbs.

Subcutaneous adipose folds: Several studies have shown that the amount of fat stored in the entire body can be predicted fairly accurately from the thickness of different subcutaneous adipose folds. To measure the amount of fat, the bodybuilder will use an instrument called an adipomete.

Several formulas are used to measure the fat content, some formulas use only 4 folds, others 7 folds or we can find some methods that include 10 fat folds.

Subjects were carefully informed of the protocol followed for the tests. Using anthropometric measurements:

Coordination speed test: 10 x 5 m in a shuttle.

Objective: to evaluate the coordination abilities on a speed exercise.

Equipment and terrain:

-1 stopwatch per participant.

- Non-slip ground, 20m long (5m shuttle and 10 times deceleration), marked at the ends (5 m) with tape. Width of the lane: about 1m.

For a group: possibility to put 2 lanes.

Test procedure: Sloping start.

Start: at the timekeeper's signal. The stopwatch starts when the participant's back foot comes off the ground.

Principle: go as fast as possible on 10 x5 m.

At each change of direction, at least 1 foot must touch the line on the ground.

Framing: Only 1 judge for the organization, the explanations and the stopwatch. Result:

Indicate the time taken to complete the 10x5 m.

Speed test of 50 m: The 50-metre race with a standing start is used to evaluate this quality.

The subject stands in the running start position.

The timekeeper stands on one of the two sides of the runner but 15 meters from the running track.

As soon as the timekeeper raises his arm indicating that he is ready, the runner can start whenever he wants.

The stopwatch is started when the runner's back foot leaves the ground, it is stopped when the runner passes in front of the finish post. The race is restarted twice at 5-minute intervals.

Test of explosive force of the lower limbs:

To evaluate this physical quality, let us choose as a test the vertical trigger [24].

This test requires a flat surface, a vertically calibrated wall, and a wall with a vertical trigger [24], from 1.5 meters to 3.5 meters from the ground and a record sheet to record the results.

Measure: (Sargent's test) the subject places the feet slightly apart, the foot closest to the wall is 30 centimeters away from it.

The jump height thus estimated was proposed as a measure of muscle power by a homonym, [25].

Test of explosive force of the lower train:

To evaluate this physical quality, the test of the quintuple jump [25], was chosen as the test. The quintuple jump is done without momentum, with start and finish with feet together. The event takes place on a track and a long jumping pit. The evaluator must have a tape measure to measure the distance of the jump per run by each individual.

The start must be with feet together, arms back and lower limbs bent.

The subject will execute five (05) successive jumps, pushing each time with the rear lower limb. The last of five (5) jumps is the finish in the pit with feet together. The event can be broken down as follows:

1) -Start: feet together. 2) -First leap: finish on one foot.

3) 4) and 5) - Link three bouncing strides. 6) - Finish in the pit with feet together.

Test of explosive force of the upper train:

To evaluate this physical quality we used the two-handed soccer ball throw test. The subject throws the ball forward with two hands.

Hands over your head, as in a football-style throw-in, feet offset in the axis of the throw, one in front of the other when throwing the front foot must not not leave the ground. The back foot may accompany the movement and go beyond the throw line.

Explosive force test: five-fold jump

The subject tries to perform four bouncing strides and finishes with a long jump in the (sand pit).

Of the three attempts on the record, the best performance is taken. This is measured to the nearest centimetre, from the tiptoe at the starting line to the place of the fall marked by the nearest heel (a backward imbalance after the fall does not penalize the performance).

Speed test - coordination:

To evaluate this physical quality we choose the 10 x 5 meter shuttle race.

This test consists of evaluating the explosive strength of the lower limbs.

The flexibility of the trunk.

Flexibility test:

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It's a flexibility test that can easily be done at home, on a sports field, or at the doctor's office. Carried out rigorously according to a simple protocol, it has the advantage of being reproducible, in order to evaluate the progress made [26].

Often wrongly considered as a reflection of the flexibility of the hamstring muscles, this exercise is really a test of the flexibility of the whole posterior chain of the lower limbs and the trunk. The improvement in flexibility results in bringing the fingers as close to the ground as possible, thus shortening the measured finger-to-ground distance.

STATISTICAL ANALYSIS

In our study, we have used descriptive statistical analysis such as arithmetic mean calculation, standard deviation calculation, coefficient of variation calculation, etc. All the statistical analyses were performed using XLSTAT software.

The coefficient of variation is defined as the ratio between the standard deviation and the mean:

Cv = standard deviation / Average .100%

RESULTS AND DISCUSSION

Anthropometric measurements

In terms of anthropometric measurements, the throwers present the profile of a large size, and a very important mass in men, on the other hand the ladies also present a profile of an average size and an average mass, and quite good wingspan according to table 1.

In the light of the scales [27-29], the fruit of their work on the evaluation of the physical qualities of young Africans from 12 to 18 years and over, the results obtained by our subjects show that they are strong, explosive, coordinated, fast and flexible for men and women according to table 2.

Evaluation of body mass: for the evaluation of the different components of body mass (muscle mass, fat mass, bone mass) we used in our study the formulas [22], which are the following:

1-Muscular mass: MM=K xH xR²(kg) K=6,5 constant=Size in cm,R=the value of the expression.

R=[(Σ Circumferences: upper arm, forearm, thigh and thigh leg)-[(Σskin folds: arm, forearm, thigh and leg)

2,4x3, 14 2,4x10

Bone mass: (kg) MO = 1.2 x T x O² Where MO: bone mass in kg.

H: size in cm O**:** the value in cm of the expression:

O = (Σ distal diameters: arm, forearm, thigh and leg) / 4

Sa: surface area of the absolute body, expressed in m², according to the following formula [23].

Sa = 1+ ([P + (H - 160)] /100) weight(kg) , Height(cm) Where Sa : absolute body surface area expressed in m².

3-Mass Adipose: MG expressed in (kg) MA=D.S.K k=constant=1,3 D=1/2(d1+d2+d3+d4+d5+d6)/12

Through our results, the javelin throwers and launchers in our sample have the highest percentage of MM 42.97%, 45.37% and a percentage of MO 17.13%, 17.00% and a low percentage of MG 10.08%, 15.30% which is an additional charge.
inutile lors de déplacement en phase des pas croisés lors du lancer de javelot.

To place a subject on the somatocard, the abscissa and the ordinate should be calculated

(x and y). X=ecto - endo

Y= 2méso-(ecto+endo)

So according to the formulas and equations, we came up with the following results:

*For men: X=0.89 Y=4.77

*For the women

X= 2,05 Y= 2,83

Descriptive analysis and interpretation for somatotype according to Heath and Carter for men [29].

Table 1: Analysis and interpretation of results for anthropometric M/W measurements.

Anthropometric measurements	Men	Women	Appreciations	
			Men	Women
The size	182,31 ± 5,08	169,42 ± 2,8	Large size	Average size
The weight	80,14 ± 8,64	64,85 ± 3,57	Important masses	Average mass
The scope	191 ± 6,15	173,85 ± 7,05	Good scope	Fairly good scope

Table 2: Analysis and interpretation of physical test results m/w.

Tests	Men	Women	Appreciations	
			Men	Women
Vertical expansion	49,28 ± 2,56	38 ± 6,45	T.B Explosive force	T.B Explosive force
Quintuple jump m	14,55 ± 1,57	11,01 ± 0,93	Excellent coordination strength.	Excellent coordination strength.
Two-handed toss of the f.ball (m)	20,46 ± 2,08	15,98 ± 1,00	Excellent explosive force.	Excellent explosive force.
Shuttle couse 10x5m dry	14,46 ± 1,24	18,52 ± 1,32	Excellent speed-coordination.	Excellent speed-coordination.
Race 50m dry standing start	6''86 ± 0,17	8''69 ± 0,44	Good speed.	Good speed.
Trunk flexion cm	19,85 ± 3,48	18,42 ± 1,90	Good suppleness	Good suppleness.

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Somatotype determines the constitutional type of the individual by classifying him or her into three components: endomorphy, mesomorphy and ectomorphy.

The study of somatotype according to Heath and Carter [29]. Revealed that Algerian launchers are of mesomorphic type, we can say that on average, our male sample is mesomorphic since the highest value is the degree of mesomorphism, which is equal to 4.33 ± 2.58, followed by the degree of ectomorphism with a value of 2.43 ± 1.16 and finally the value of the degree of endomorphism which is equal to1.54 ± 0.44 according to table 5.

DISCUSSION

This research aims at evaluating the physical qualities and the morphological profile of the best Algerian pitchers for the senior category, their body composition as well as the determination of their somatotype in this speciality of athletic throwing.

Fourteen male and female athletes composed of seven male and seven female javelin throwers with an average age for men is (25.28 years ± 5.08), (23.71 years ± 2.81) for women and representing the best Algerian pitchers men and women of the sports season 2014, have pries part in this study. They have all submitted to anthropometric measurements (weight, height, span) and physical tests (Test of Speed Running 50 meters standing start, Test of coordination shuttle race (10x5m), test of throwing soccer with two hands (explosive force of upper limbs), test of vertical relaxation (Sargent test for explosive force of lower limbs), test of flexibility. Test of quintuple jump (coordination strength).Referring to the classification tables of the human species and to the study by Cazorla et al. on anthropometric measurements and physical tests, a study that allowed the elaboration of scales of physical value for young people from 12 to 18 years old and over.

This study allowed the development of scales of physical values for young people aged 12 to 18 and over, as well as the percentages of muscle, fat and bone mass using Matiegka's formulas) and to determine the somatotype for each category of men and women in the javelin throwing event following Heath and Carter's method.

Table 3: Analysis and interpretation of the results of the body mass components m/w.

The components of body mass	Men (average)	Women (average)
MM(%)	42,97 ± 6,91%	45,37 ± 0,08%
MO(%)	17,13 ± 3,99%	17,00 ± 0,04%
MG(%)	10,08 ± 0,01%	15,30 ± 0,01%
IMC(%)	24,3 ± 2,58%	22,5 ± 0,93%
SA (m2)	2,02 ± 0,12%	1,73 ± 0,08%

Table 4: Analysis and interpretation for men and women somatotyping

Sexe/ somatotypie	Men (average)	Women (average)	Morphological profile	
			Men	Women
Endomorph	1,54 ± 0,44	1,76 ± 0,41	/	/
Mesomorph	4,33 ± 2,58	3,97 ± 0,93	4,33	3,97
Ectomorph	2,43 ± 1,16	3,69 ± 0,53	/	/

Table 5: Presentation of the average somatotype for men.

Somatotyping for Men	Endomorphic	Mesomorphic	Ectomorphic
Average	1,54	4,33	2,43
Standard deviation	0.44	2,58	1,16

Concerning the anthropometric measurements we can retain that:

- For the height, (182.31 cm ± 5.08), our male subjects are tall while the ladies (169.42 cm ± 2.8) are of medium height.
- For the weight, (80.14 kg ± 8.64) our pitchers have a large mass, on the other hand our female pitchers have an average body mass (64.85 kg ± 3.57).
- For the wingspan, (191 cm ± 6.15) our male population has a good wingspan while the female population (173.85 cm ± 7.05) has a fairly good wingspan according table 1.

Concerning the results of the physical tests we can retain that:

- Our throwers have a very good explosive strength in the lower limbs (vertical trigger with an average of (49.28 cm ± 2.56) and a very good strength - coordination (fivefold jump with an average of (14.55 m ± 1.57).
- They also have excellent explosive strength in the upper limbs (soccer ball throw with an average of (20.46 m ± 2.08).
- They have an excellent speed coordination (shuttle run 10 x 5 m with an average of (14"46 sc ± 1"24).
- They have a good running speed of 50m with an average of (6"86 sc ± 0"17).
- And finally they have a good flexibility at the level of the trunk with an average of (19.85 cm ± 3.48).
- As well as the results of the physical tests we can retain that :
- Our throwers have a good explosive strength in the lower limbs (vertical trigger with an average of (38 cm ± 6.45) and excellent strength - coordination in the lower train (five times jump with an average of (11.01 m ± 0.93).
- They also have excellent explosive strength in the upper train (soccer ball throw with an average of (15.98 m ± 1.00).
- They have a good running speed of 50 m with an average of (8"69 sec ± 0"44).
- An excellent speed coordination race shuttle 10 x 5 cm with an average of (18"52 ± 1.32).
- And finally, they have a good flexibility at the level of the trunk flexion with an average of (18.42 cm ± 1.90).

Regarding the body composition, we found, through our results, that the javelin throwers in our male sample had the highest percentage of muscle mass(42.97% ± 6.91), and a percentage of (17.13% ± 3.99) of bone mass and a lower percentage of fat mass (10.08%± 0. 01), the same results that we also found in the throwers an average of (45.37%±0.08) of higher muscle mass and a percentage of (17% ± 0.01) of bone mass, and a percentage of (15.30% ± 0.01) of lower fat mass as well as a mass index of (15.30% ± 0.01) body of according table 2.

The study of the somatotype according to Heath and Carter

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revealed to us that the Algerian launchers are of mesomorphic type, we can say that on average, our male sample is mesomorphic since the highest value is that of the degree of mesomorphism which is equal to 4,33 ± 2. 58, followed by the degree of ectomorphism with a value of 2.43 ± 1.16 and finally by the value of the degree of endomorphism which is equal to 1.54 ± 0.44. The same thing for our ladies sample is mesomorphic since the highest value is the degree of mesomorphism 3.97±0.93 followed by the degree of ectomorphism 3.69 ± 0.53 and finally the value of the degree of endomorphism 1.76 ± 0.41. Concerning the morphological profile of an Algerian and Algerian javelin thrower, they are natural athletes with a medium skeleton and having developed and toned muscles (they are mesomorphic people Characterizes a square stature and predominant muscles.

Usually, the skeleton of the legs, trunk and arms is massive, the forearms,The wrists and hands are wide, high degree of mesomorphism that increases with the weight of the device). The mesomorph has an athletic physique. He is naturally endowed with a broad skeleton, a good muscle mass and a relatively low fat mass. Its other physical characteristics are broad shoulders (more than the pelvis in men, as much in women).

However, morphology is not everything, and although it gives advantages in various disciplines such as shot put, discus and hammer throw, this could be explained by the fact that the javelin throw is the only athletic throwing event that uses a run-up to reach a fairly high optimal speed, which requires the javelin thrower to have little body fat which is an unnecessary additional load when moving.Training remains the predominant factor in success and it alone makes the difference between the level of the athletes. Usain Bolt is an athlete with an ectomorphic morphology, which does not prevent him from being the world number one in the 100 and 200 meters in athletics.

On the map, we also notice that the somatotypes are not scattered and that they are located above the abscissa axis. We also note that the women subjects have a predominance of the mesomorphic component.These results are consistent with those of several research studies that have looked at somatotypes characterizing strength specialties, including athletic throwing [2,29,30] and that indicate that athletes specializing in strength and power disciplines have a somatotype with a mesomorphic component that is by far the most dominant.

On the map, we also notice that the somatotypes are not scattered and that they are located above the abscissa axis. We also notice that the women subjects have a predominance of the mesomorphic component according to table 6. The same thing for our women's sample is mesomorphic since the highest value is mesomorphic degree 3.97 ± 0.93 followed by ectomorphic degree 3.69 ± 0.53 and finally endomorphic degree 1.76 ± 0.41 according to table 6. Data analysis and discussion of the results led to the conclusion of this research.

To know if the pitchers have the qualities and an acceptable profile to successfully practice this speciality of throwing? We can say that our group is weak compared to the results of the javelin throwers of the mundialists, in spite of the fact that they possess considerable physical qualities, it means that our group is far from the international elite.

CONCLUSION

The throwers present the profile of a subject of large and medium size, a very large mass in males.

On the physical level, ladies have an average body mass. In terms of wingspan a fairly good wingspan in women, on the other hand, our men population has an excellent wingspan. Our pitchers have a Normal Body Mass (NBM).

We can therefore say that those who took part in our experiment have fairly good physical qualities and an acceptable profile to throw the javelin as far as possible. So although our throwers have good physical qualities and also have a template that allows them to throw the javelin at a high level, but the performance of the throwers will not be up to the African and world performances.

Table 6: Presentation of the somatotype for women [30].

Somatotyping for women	Endomorphic	Mesomorphic	Ectomorphic
Average	1.76	3.97	3.69
Standard deviation	0,41	0.93	0.53

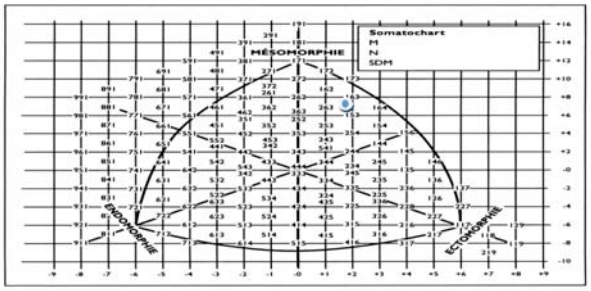

Figure 1: Graphical representation of somatotype results for men on the somatocard.

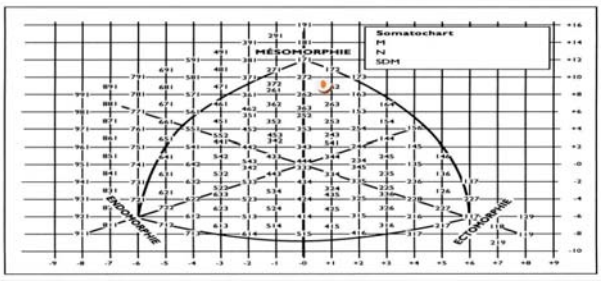

Figure 2: Graphical representation of somatotype results for women on the somatocard

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