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The study of some morphological parameters and their correlation with the vertical jump of the volleyball players under 16 years old

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Abstract

The goal of our research is to study the vertical jump and its correlation with some morphological parameter of the volleyball players. 14 volleyball players have participated in this study. Their average age is 15±08 year old.

Still we realized some morphological measures and 2 tests of the vertical jump on the sample, knowing that the squat jump (SJ) is a test to determine the maximum load of the lower extremities. The morphological measures are obtained thanks to anthropometric case (SIBERHEGNER) and through the myotest-pro, we've calculated the strength of the lower extremities. The result has permitted us to see that there is a correlation between the length of the lower lamb and the jump's high, the length of the jump and the speed of the execution and the jump's high.

I. Introduction:

The Morphological criteria represent the first level of the determining factors of performance. They are often considered as the basic factors for any sport selection. For this, several studies seek to determine the ideal morphotype for each sports specialty in order to improve the performance. (Sadouki kamel, 2018 p 61).

The studies indicate that the body composition affects the level of sporting success to different degrees, depending on the performance component and the nature of the sports specialization and the nature of the performance. (2020 صياح زكريا وآخرون, page 136).

The physical structure and physical type play a role in the appearance of the physical and professional form of the individual which represents a number of determinants of sports performance and in turn affects the general level of planning performance, especially in football and other group games. (2020 بلغريسي وآخرون, page 111).

The Anthropometric measurements are important and essential to determine the type and physiological and physical characteristics of an athlete, because it is the study of the forms, sizes and proportions of the different parts of the body. (2019 بوقشوط أحمد وآخرون, page 290)

The practice of the volleyball in a high level requires succeeding a lot of physics qualities, techniques, tactics and psychologist. Among the essential physics qualities, the vertical jump.

In the game of volleyball, the vertical jump plays particularly an important role, because a lot of action games depend on it. In fact the importance of a jump is useful either if it's for smash, block or for the attack service.

In a match of 5 sets, the attacker jump about 150 to 200 times, the third of these jumps fits in an attack. Two thirds in a block (CARDINAL 1993).

WEINECK (1997) define the vertical jump as the characteristic that allows the extensor muscle to rise in a time unit, the gravity center of the body as highest as possible. This parameter is difficult to quantify in a match, therefore different field test are used. (ODELOYINDO AND COLL 1995 COMETTI 1998).

We used anthropometric measurements to study the correlation between the quality of the jumps and the morphological parameters; this combination is decisive according to Corroyer. (Corroyer 2019).

The volleyball is a sport that needs an important quality of jumping and a good morphology in order to perform the different technical types: of receiving, of blocking and of the attacking.

The morphology is one of the sciences that has been interested in sport .
For that we ask the following question: has the vertical jump a direct link with the morphological parameters?

II. Method and Materials:

2-1 Participants

The sample consists of 14 players whose average age is 15 ± 0.8 and who regularly practice volleyball at the rate of 4 training sessions per week and a competition during the weekend, this team of the Cadet category is considered one of the best nationally. (Table N ° 1)

Table 1: representation of the volleyball players total parameter

Team	N	Age (y.o)	Weight (kg)	Stature (cm)
	14	15±0.8	71,7 ±11.41	175±7.13

2-2 Materials:

Based on the study, an analytical descriptive approach was used because it suits the nature of the research, where the researcher analyzes the phenomenon studied and after he finishes studying this phenomenon, he makes comparisons between it and the other phenomena and then analyzes it. (2020 بن الطاهر اسماعيل وآخرون p.222) Where an anthropometrics measures has been executed on each subject of our population. The technique used in these is that of the direct measurement of the body and its segments, according to the based anthropometric techniques. The land marks osseous and the measurements have been standardized by MARTIN (1928), VALLOIS (1948) then by ROSS & MAEFELL-JONES (1988).

2-3 The anthropometric method

The measurements on all subjects have been done by the same group of investigators, at the same hour.
The use of the anthropometric methods is easy and non-invasive. for that we have used an anthropometric case type GPM (SiberHegner) containing the MARTIN system's anthropometric destined to measure linear dimensions (longitudinal) and transversal of the body ; a thick compass with olive ends to measure the transversal dimensions ; one meter ribbon to measure the perimeter of the body (circumference) and its segments.
We have proceeded to calculate a certain index of the physical development

namely:

-The index of KAUP expressed by P/T^2 (g/cm^2) named also « Body build index » of DAVENPORT. For this index, the interpretation of the result relies on the elaborated scale by DAVENPORT (in VANDERVAEL, 1980) (Table 2).

Table 2: Evaluation of the KAUP index according to the DAVENPORT scale

1.4 à 1.80	Very thin
1.81 à 2.14	Thin
2.15 à 2.56	Medium
2.57 à 3.05	Corpulent

(VANDERVAEL, 1980)

- QUETELET index: expressed by P/T (g/cm), according to the literature, the values of this index are for the sedentary of 350g/cm and for the athletics of high level of more than 400g/cm.
- SCHEREIDER index: (quoted by Schreider 1953) that informed us about the robustness state of an individual whose formula is: P/S (weight/ area, expressed in kg/m^2).
- SHELDON index: expressed in T/3P, index that determine a willowy individual.
-The absolute area of the body is calculated according to the formula OD DUBOIS & DUBOIS (1916): $S = 0.0007184 * T^{0.725} .P^{0.425}$ (Weight of the body in Kg, Size in cm).
- The shoulder index: is the distance from the highest salient points of the acromion process, which is on the spine of the scapula.
- SKELE index or The MANOUVRIER skelic index is the relationship between the length of the lower limb and the height of the bust. Oliver .G (1961).

2-4 Test physical Method

- Measure the jump through tests, using Myotest-Pro Squat Jump of five (05) jumps (Myotets-pro).

Field test (attack and against jump) with and without momentum.

- Fat component $D = d * S * k$ D = fat quantity (Kg). d = the average thickness of the skin fold with the skin thickness (mm) which is equal to half the sum of seven skin fold. S = skin area (m^2). k = constant determined by experimental way, equal to 1,3.
- Muscular component (MM) $M = L * R^2 * K$

M = absolute quantity of muscle tissue (kg);
L = length of the body in cm;
R = the average size of arm rays, forearm, of the thigh and the legs in the place where the muscle volume is most developed;
K = constant equal to 6, 5;
R = □ [circumference (arms, forearm, thigh, leg) / 2□ r*4] - □ [skin folds (arms, forearm, thigh, leg) / 2*4*10].
- Bony component (MOs) to define the absolute mass of bony tissue, there is the following applied formula: MOs = L * o2 * K or o² = □ [diameters (arms, forearm, thigh, and of the leg)/4]² or: Os = the absolute mass of bony tissue (Kg); L =length of the body in cm; K = constant equal to 1, 2.

2-5 The statistic method

The researcher resorted to the SPSS program to calculate the following equations:

-Arithmetic average
-standard deviation
-coefficient of variation
- Student test. (t)

III. Results:

3-1 Total parameters (age, practice duration, weight, size). The size presents a coefficient of variation

Table 3: Representation of total characters

Value	Age (y.o)	Weight (kg)	size (cm)
Medium	15±0.8	71±11.41	175±7.13
Minimum	14	56.20	161.00
Maximum	16	94.00	191.00
C.V %	22.02	16.08	4.08

- The average age of our samples is of 15±0.8 years old with a minimum value of 13 years old and maximum of 16 years old, the coefficient of variation expressed an average homogeneity with a value of 22.02 %.
- The average weight of our volleyball players of the club is of 71±11.41 kg, with a minimum value of 56.20 kg and maximum of 94 kg. The coefficient of variation is 16.08 %, it shows a big homogeneity between the subjects.

- The average size of our sample is 175±7.13 cm, a minimum value of 161 cm and maximum of 191 cm. The coefficient of variation is 4.08% that shows homogeneity.

3-2 The longitudinal dimension of the volleyball player's upper extremities:

Table 4: representation of the length of the upper extremities

Value	Upper extremitiess	Arms	Forearm	Hand
Average	79.12±4.81	35.96±2.47	25.44±2.08	18.72±1.45
Minimum	73.6	31.2	22.2	17.2
Maximum	90	39.3	29.2	21.5
C.V %	6.08	7.08	8.19	7.76

-The average value of the upper extremities' length recorded among our volleyball player is 79.12±4.81cm, with a variation coefficient of 6.08% which shows an important homogeneity at the level of this segment.
-The medium value of arm's length recorded among our volleyball players is 35.96±2.47 cm with a variation coefficient of 7.08%, which signifies a big homogeneity at the level of this segment.
-The medium value of the forearm recorded among our volleyball players is 25.44±2.08 cm with a variation coefficient of 8.19%, which signifies a big homogeneity at the level of this segment.
-The medium value of the hand's length among our samples is 18.72±1.45 cm with a variation coefficient of 7.76%, which signifies homogeneity at the level of this segment.

3-3 the longitudinal dimensions of the volleyball players upper extremities

Table 5: representation of the upper extremities length

Value	Upper extremities	thigh	Leg
Medium	97.66±5.53	48.92±3.09	41.15±4.15
Minimum	88.05	44.4	36.2
Maximum	102.94	52.4	48
C.V %	5.67	6.32	10.09

-The medium value of the upper extremity's length recorded among our samples is 97.66±5.53cm with a variation coefficient of 5.67%, which signifies a big homogeneity at the level of this segment.
-The medium value of the thigh's length recorded among our volleyball players is 48.92±3.09 cm with a variation coefficient of 6.32%, which signifies a medium homogeneity.

-The medium value of the thigh's length recorded among our volleyball players is 41.15±4.15 cm with a variation coefficient of 10.09% which express homogeneity at the level of this segment.

3-4 the longitudinal dimensions of the body, sitting size of the volleyball player.

Table 6: A representation of the body's lengths, sitting size

Value	Size (cm)	body (cm)	Sitting size (cm)
Average	175±7.13	50.48±3.12	83.9±3.74
Minimum	161.00	46.7	80.4
Maximum	191.00	57.9	91.6
C.V%	4.08	6.19	4.45

-Concerning the body, the average value of the volleyball player is 50.48±3.12 cm, the coefficient of variation express homogeneity of 6.19%.
-For the sitting size, their average value of the size's length sitting is 83.9±3.74 cm, with a variation coefficient of 4.45% which express an important homogeneity.

3-5 the transversal dimensions of the volleyball players

Table 7: representation of transversal dimension

Value	Bi.acro	Disstal arms	D.forearm	Hand	Bitroch	Distal thigh	Distal leg	Foot
Med	29,46 ± 2.19	6.35 ± 0.90	5.21 ± 0.43	7.44 ± 0.68	32.89 ± 2.72	8.56 ± 0.75	7.04 ± 0.65	8.86 ± 0.82
Min	24.70	5.20	4.30	5.60	28.60	7.40	6.30	7.30
Max	31.90	8.10	6.00	8.00	39.20	9.70	8.50	10.0
C.V%	7.43	14.15	8.30	9.20	8.27	8.71	9.26	9.29

-The bi acromial diameter: the volleyball players represent an average of 29, 46±2.19 cm, with a variation coefficient of 7.43% which express a strong homogeneity.
-The distal diameter of the arms: We notice an average of 6.35±0.90cm, with homogeneity of 14.15% at the level of this diameter.
-The distal diameter of the forearm: the average value is 5.21±0.43cm, the coefficient of variation express a homogeneity of 8.30%.
-The hand diameter: the average value is 7.44±0.68cm and a variation coefficient of 9.20% which signify an important homogeneity.
-The bitrochonterien diameter: we note a medium value of 32.89±2.72cm. The variation coefficient indicates homogeneity of 8.27%.

-The distal diameter of the thigh: we find an average value of 8.56 ± 0.75cm and homogeneity of 8.71%.

-The distal diameter of the leg: our group represents an average value of 7.04 ± 0.65cm and a coefficient of 9.26% which expresses homogeneity.

-The foot diameter: the volleyball players represent an average value of 8.86 ± 0.82cm, with a coefficient of variation of 9.29% which means a high homogeneity.

3-6 the circumferences of the volleyball players:

Table 8: representation of the circumferences

Value	Thorrest (cm)	Contra Arm (cm)	Relax arm (cm)	Forearm (cm)	Hand (cm)	Abdo (cm)	Basin (cm)	Thigh (cm)	Leg (cm)
Med	98.36 ± 4.88	29.90 ± 2.76	27.42 ± 2.94	24.39 ± 1.76	17.54 ± 5.20	83.26 ± 6.00	101.28 ± 8.64	57.48 ± 4.58	34.98 ± 2.39
Min	83.00	27.10	24.30	22.30	2.02	72.50	83.80	53.00	32.0
Max	98.00	35.00	34.00	28.50	20.00	92.00	118.5	69.50	41.0
C.V%	5.46	9.24	10.73	7.24	3.28	7.21	8.54	7.97	6.83

- **The perimeter of the thorax at rest:** the volleyball players represent an average of 98.36 ± 4.88 cm, with a coefficient of variation of 5.46% which expresses a strong homogeneity.

- **The perimeter of the contracted arm:** volleyball players represent an average of 29.90 ± 2.76cm, with a coefficient of variation of 9.24% which expresses homogeneity.

- **The perimeter of the relaxed arm:** the average value recorded in our sample is 27.42 ± 2.94cm, with homogeneity of 10.73%.

- **The perimeter of the forearm**: we notice an average of 24.39 ± 1.76cm. The coefficient of variation is 7.24% which means homogeneity.

-The perimeter of the hand: we note an average value of 17.54 ± 5.20cm. There is significant homogeneity in this segment 3.28%.

- **The perimeter of the abdomen:** our group represents an average value of 83.26 ± 6.00 cm and a coefficient of variation of 7.21% signifying great homogeneity.

- **The perimeter of the pelvis:** the average value retained is 101.28 ± 8.64cm, with a coefficient of variation of 8.54% which expresses the group's homogeneity.

- **The perimeter of the thigh:** an average value of 57.48 ± 4.58cm.A coefficient of variation of 7.97% which means that there is homogeneity.

- **The perimeter of the leg:** the volleyball players recorded an average value of 34.98 ± 2.39cm and a coefficient of variation of 6.83% which means homogeneity.

3-7 the skin folds of volleyball players

Table 9: representation of skin folds

Value	S/Scapulare	Bicipital	Tricipital	Forearm	Belly	Supra-iliac	Thigh	Leg
Med	14.87±5.29	8.71±4.26	19.15±5.87	7.66±3.73	23.01±4.18	16.06±8.23	28.61±7.27	26.73±6.35
Min	8.00	4.00	10.80	4.00	15.00	6.20	15.00	19.40
Max	25.00	16.00	29.80	14.08	30.00	29.00	39.00	39.00
C.V%	35.55	48.92	30.66	48.73	18.16	51.86	25.40	23.77

- **The subscapular fold:** the average value is 14.87 ± 5.29 mm. The coefficient of variation is 35.55% which expresses heterogeneity.
- **The bicipital fold:** the average value of our sample is 8.71 ± 4.26 mm with a coefficient of variation of 48.92% which means significant heterogeneity.
- **The tricipital fold:** the average value is 19.15 ± 5.87mm there is heterogeneity of 30.66% between the volleyball players.
- **The fold of the forearm:** the average value is 7.66 ± 3.73mm is a great heterogeneity represented by the coefficient of variation of 48.73%.
- **The belly fold:** the average value recorded is 23.01 ± 4.18mm. The coefficient of variation is 18.16% which expresses heterogeneity.
- **The supra-iliac fold:** an average value of 16.06 ± 8.23 mm the coefficient of variation of 51.86% which means that there is heterogeneity.
- **The fold of the thigh:** the average value is 28.61 ± 7.27 mm and a coefficient of variation of 25.40% expresses significant heterogeneity.
- **The leg crease:** the average value recorded is 26.73 ± 6.35 mm with heterogeneity of 23.77%.

3-8 the components of body weight

Table 10: Representation of the components of body weight

Value	Fat Comp. (kg)	Fat Comp. %	Muscle Comp. (kg)	Muscle Comp. %	Bony Comp. (kg)	Bony Comp. %
Med	21.37±4.97	21.37	26.27±5.6	26.27	9.84±1.97	9.84
Min	16.28	16.28	20.17	20.17	6.9	6.90
Max	31.1	31.10	36.84	36.84	13.94	13.94
C.V%	23.26	23.26	21.33	21.33	19.98	19.98

- By reading the table above, it emerges that the average value of the fat component of our sample is 21.37%, with a coefficient of variation of 23.26%, which expresses heterogeneity.
- We note a muscle mass of 26.27%. Homogeneity of 21.33% expressed by

the coefficient e variation.

- For bone mass, it has an average of 9.84%, with a coefficient of variation of 19.98% which means homogeneity in this component.

3-9 Indexes of physical development for volleyball players:

Table 11: representation of physical development indices

Value	Kaup Index	Quételet Index	Schreider index(kg/m2)	scheldon index (cm/kg)	Abs.surf. body
Med	22.37±2.13	405.15±57.49	38.01±3.03	42.76±1.82	1.86±0.17
Min	22.37	405.15	38.01	39.07	1.86
max	19.60	343.22	34.52	45.12	1.57
c.v%	27.01	540.23	45.19	4.25	2.17

-By analyzing the Kaup index, we were able to determine the average value of volleyball players which is 22.37 ± 2.13 g / cm3, the coefficient of variation expresses a great homogeneity of 27.01%.

- For the Quételet index, the average value is 405.15 ± 57.49 g / cm with a coefficient of variation of 540.23% which means that there is homogeneity between the volleyball players.

- For the Schreider index, the average value of the whole group is 38.01 ± 3.03 kg / m2. With a coefficient of variation of 45.19% which means significant homogeneity.

- For the Scheldon index, the average value is 42.76 ± 1.82 cm / kg and a coefficient of variation of 4.25% which expresses great homogeneity.

- For the absolute surface of the body, the average value of our sample is 1.86 ± 0.17 m2 and a coefficient of variation of 2.17% which means that there is a homogeneity.

3-10 Representation of shoulders and Skele index of volleyball players.

Table 12: Representation of shoulders and Skele index

Value	Shoulders Index %	Skele Index %
Medium	14.87±5.29	125.68±8.40
Minimum	8.00	4.00
Maximum	25.00	16.00
C.V%	35.55	6.68

-For the Shoulders index, we have an average value of 14.87 ± 5.29% and a coefficient of variation of 35.55% which signifies significant homogeneity.

- The average value of the Skele index of volleyball players is 125.68 ± 8.40% which means that they are Macroskele type. The coefficient of variation is 6.68% which means that there is a homogeneity.

Ⅳ- Correlation between physical and morphological test results.

Table 13: representation of correlation results

Value	Height	Jump without momentum	Jump with Momentum	H (cm)	P (w/kg)	P. MAX (w/kg)	Force (n/kg)	speed (cm/s)	L.M.I	Thigh L.	Leg L.
Med	291.32	2.91	3.55	28.70	41.55	44.38	42.96	222.14	97.68	48.94	41.15
Ecartp	15.06	1.38	1.37	3.71	6.90	6.18	6.47	16.69	5.33	3.09	4.15
c.v	38.60	12.94	16.61	13.92	15.06	7.51	5.66	6.31	5.67	6.32	10.09

Table 14: representation of correlation results.

Significance level: 0.05 / degree of freedom: 13 / scheduled correlation value: 0.658
R: correlation value / ***N***: Signification

Value	Height Cm		P (w/kg)		P. MAX (w/kg		Strength (n/kg)		Speed (cm/s)	
	R	***N***	***R***	***N***	***R***	***N***	***R***	***N***	***R***	***N***
LMI	0.787	*	0.520	Ns	0.526	ns	0.245	Ns	0.825	*
Length of the THIGH	0.707	*	0.410	Ns	0.310	ns	0.288	Ns	0.792	*
Forearm length	0.610	*	0.235	Ns	0.345	ns	0.95	*	095	*
Length LEG	0.423	Ns	0.690	*	0.750	*	0780	*	0.528	Ns
Muscular mas	0.825	*	0.524	Ns	0.721	*	0.709	*	0.341	Ns

According to the results of table N °13 & 14, we noted several significant correlations between the physical tests and the various anthropometric parameters.

The length of the lower extremities has a significant correlation with the height of the jump as well as the length of the leg which is also correlated with the speed of execution.

On the other side, the length of the thigh has no correlation with the parameters of the jump. The length of the forearm and legs improves the skill of volleyball players, these morphological criteria that should not be

overlooked. So these results come on same context as the results of both (فوقية ابراهيم وأخرون 2018 P363) and (بوحاج مزيان و آخرون 2018 P147).

The analysis of the correlations between the morphological parameters and the parameters of the vertical jump put an obvious correlation.

- There is a clear correlation between the length of the upper and the lower member during the jump so the correlation value is 0.778 and it's bigger than the scheduled correlation value which is 0.658 at the level of significance which is 0.05.
- There is also a reverse relationship between the length of the forearm and the power where the correlation value is 0.235 that is smaller than the scheduled correlation value which is 0.658 at the level of significance which is 0.05.
– There is a reverse correlation between the leg length and the speed where the correlation value is 0.528 that is smaller than the scheduled correlation value which is 0.658 at the level of significance which is 0.05.
- There is a clear correlation between the muscle mass and the jump length and the strength, so the correlation value is 0.825, 0.709 respectively, it's bigger than the scheduled correlation value which is 0.658 at the level of significance which is 0.05. And as (COMETTI, 1995) indicates, we therefore believe that the development of muscle mass has a real impact on the development of the jump indices, especially in terms of strength.

This leads us to say that these two parameters have a close relationship with vertical jump in volleyball players.

These are parameters that should be taken into account in future selections.

We noticed the presence of a correlation between the morphological parameters and the jump height and the strength and the speed, where it helps the player on performing the skill of blocking with such a good way, so it matches what (بوحاج مزيان و آخرون 2018 P235) found.

The morphological measurements are considered as a characterization that affects positively on the height of the jump and that what (بوحاج مزيان و آخرون 2018 P142) reached.

IV. DISCUSSION:

For results for all body lengths, the average value of the upper limb length recorded by our ASJK volleyball players of (79.12 ± 4.81 cm), and showing significant homogeneity in this segment. (KOZLOV V I, GLADISHEVAA, 1976).

The average value of the forearm length recorded by our ASJK volleyball

players is (25.44 ± 2.08 cm), also noting a homogeneity in this segment. We noted that these segments are important for the development of the detente indices. (COMETTI G, 2006).

For the trunk and the seated waist, the average value of ASJK volleyball players is respectively (83.9 ± 3.74 cm), and (4.45%), the coefficient of variation presents an important homogeneity.

By reading the results of the body mass, it appears that the average value of the fat component of our sample is (21.37 ± 4.97 kg), with a coefficient of variation of 23.26%, which expresses heterogeneity. We find the muscle mass with an average value of (26.27 ± 5.6 kg). Homogeneity of 21.33%, expressed by the coefficient of variation. For bone mass, it has an average of (9.84 ± 1.97 kg), with a coefficient of variation of 19.98% which means homogeneity in this component.

Suppose that the adiposity varies in the same way as the skin folds, that the bone mass varies according to the length of the bones, that the muscle mass varies according to its circumference corrected by the thickness of the skin fold, and that the residual mass (internal organs, viscera, lipids) varies depending on the size of the chest, we found that the skin folds were very important in our volleyball players.

By analyzing the indices of physical development:

- The KAUP index has an average value of (22.37 ± 2.13).

The coefficient of variation expresses a low homogeneity; according to the DAVENPORT scale, volleyball players have a normal constitution. (VANDERVAEL F, 1980)

-For the QUETELET index, the average value is (405.15 ± 57.49) with a coefficient of variation of 54.23% characterizing good robustness of volleyball players (greater than 350 gr / cm). (QUETELET A, 1870)

-For the SHELDON index, linearity index, our volleyball players have significant stature parameters. The SHELDON index tells us about the linearity of the individual. (SHELDON. W.H, 1961).

-The larger the values of this index, the more slender the individual.

-For the absolute surface of the body, informing us about the physical development of the individual, the average value of our sample is 1.86 ±

0.17 m^2 and a coefficient of variation of 2.17% which means that there is homogeneity. Our volleyball players have a good constitution.

-The average value of the SKELE index of our volleyball players is (125.68 ± 8.40) which means that they are Macroskeles type according to the SKELIQUE index of MANOUVRIER. (HEATH&CARTER.1990) .

- We found that most of the morphological parameters have a correlation with the vertical jump that effects the skills performance of the volley ball players and that what (Haceini Ayoub 2020 page 11) has confirmed.

V. Conclusion:

The importance of morphological aspects is not unique to the volleyball specialty and can be justified by the exercise of taking into account the morphological characteristics of the athlete to claim efficient planning of his development and evaluation of his performance status by training. The results showed the existence of significant correlations at p 0.05 between the lower extremities and leg lengths, the speed and jump height power tests.

On the other hand, there is no correlation between the thigh and the non-significant difference speed indexes.

We recommend better management of lower limb (thigh and leg), during training in terms of fat reduction and increase in muscular mass. The musculature is an essential parameter for the development of jump.

We also noted very significant correlations at 0.05 respectively between the lower limbs and the maximum power.

We estimate that these parameters could constitute indices of estimate of the power of the lower limbs. It would be interesting to propose an appropriate program for the development of the vertical rebound and to check if it is maintained or regains its initial value. It would also be interesting to quantify precisely, the volume of the muscle mass of the thigh and the leg, to identify possible correlations with the vertical jump and the power of the lower limbs.

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