CHAPTER
100

Body composition of an elit de jockey team - Argentina flows model

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ABSTRACT
Hockey is a team sport with a significant energy expenditure due to the different skills and physical conditions required, so it is common that in sports practice the player wants to increase their muscle mass through the use of exogenous aids such as protein supplements. The present study aimed to determine the body composition according to the food plan carried out and position occupied in the field of play of 14 male hockey players on synthetic turf - between 18 and 30 years old-, of first and second division, of the Club Ferrocarril Mitre of the party of San Martín, province of Buenos Aires, Argentina. The dietary variables presented by the players were taken into account and divided into three groups: Group A: subjects who make a food plan without consumption of supplements. Group B: subjects who carry out a meal plan with protein consumption. Group C: subjects who did not consume protein supplements and begin to do so. The measurements were made by a trained and standardized anthropometrist on two occasions; the first at the beginning of the study and the second eight weeks later using the ENFA method. Significant differences were found in the team with larger skeletal size ($p = 0.0001$), greater amount of muscle mass ($p = 0.0018$) and lower amount of fat mass ($p = 0.0001$) in relation to the Phantom and differences in the somatotype between players who occupy different positions on the playing field. In addition, an increase in muscle mass was observed in group C. ($p=0.05$)

Keywords: Body composition, ENFA, men's field hockey, protein supplements, ® muscle mass.

1 INTRODUCTION

Hockey is a team sport that emerges, according to the background, 3000 years B.C. as a semi-organized activity. The precursors were China, Persia and India, widely civilized peoples for the time. The bases of this sport were born in England and Ireland in the first half of the nineteenth century, but England is considered the cradle of this sport since there, in 1876 the London Hockey Union is created, where a unique interpretation of the regulations is made. Later, in 1908 the sport was incorporated into the Olympic Games. (1)

The arrival of hockey in Argentina occurred gradually thanks to the British immigration of the nineteenth century, who carried it out as a cultural practice. (2) In 1908 the Argentine Hockey Association (AAH) was founded in Argentina. (1)

Hockey is regulated internationally by the International Field Hockey Federation (FIH), which was founded in 1924 by Belgium, France, Austria, Switzerland, Spain, Czechoslovakia and Hungary. (2). It is an invasive game with a significant energy expenditure (30 to 50 kj / min) due to the different skills and physical conditions required, since aerobic and anaerobic efforts are made. It is also influenced by external factors such as the size of the field, which has length and width, as well as the asymmetry of the hockey stick. Each team is made up of 11 players who play in two periods of 35 minutes, with the aim of making more goals to the opposing team. (3) 90 metros55 metros.

1.1 ANTHROPOMETRY: BACKGROUND

In relation to the anthropometric variables described for this sport, Hirata (4) concluded, from the assessment of hockey players at the Tokyo Olympic Games, that they were similar to football players. He considered the minimum and maximum age for players to be 24 to 27 years, achieving success earlier in football and later in hockey.

However, a comparative study between an elite group with a sub-elite group has shown that in addition to tactical qualities, attention and motivation, the youth of the players is a factor to consider. (5) (6).

It was later determined that the evolution of game formations in Hockey initially followed the same pattern as Football.

(7) In addition to the diversification in the playing formations used, the use of synthetic surface has changed playing styles in such a way that players can now swap positions in the course of a match.

The height and average weight of the Indian team winning the Olympic medal at the Tokyo Games was and 69.2 kg (4). The Pakistan team and all non-Asian teams were taller and heavier.

The small size of the Indian team (8) and the national police team (9) reflect the smaller stature and body weight of the Asian population more than elite hockey players. The elite South African players studied by Scott (10) had an average height of 176.3 ± and a weight of 75.2 ±. 173 cm6.5 cm8.1 kg

Sodhi and Sidhu (11) compared provincial-level hockey players with similar soccer players. Forwards, defenders and midfielders in hockey had higher anthropometric values and more muscle mass in their limbs, compared to analogous positions among footballers.

For all field positions, hockey players presented higher values of fat mass and therefore more final weight in relation to football players.

This result is supported by the findings of Withers et al (12) who observed that Australian hockey players at provincial level had a marginally higher fat percentage than a similar group of Football players (16.7 vs 15.7). A subsequent study by the same research group (13) described an

average of 10.3% fat for hockey players, even higher than the 9.7% observed in footballers. The lower values in the latest study could reflect more intense training than in the past decade.

The average body fat percentage of the 162 elite players from 12 South African club teams competing in the Senior Provincial tournament was 11.1 ± 3.3%.

There was a relationship between the team's average fat mass percentage and its final position in the tournament. Similar results in relation to fat mass were described by Scott. (10)

Wilsmore (14) concluded that the somatotype is important to differentiate players in different playing positions.

In general, there was a tendency of all players towards mesomorphism, but more in defenders and midfielders than in forwards. Defenders as a group had a higher endomorphism than midfielders or forwards, and a lower ectomorphism. This somatotype profile makes them less mobile but stronger than all field players.

The average somatotype of provincial-level Indian players studied by Sodhi and Sidhu (11) was 3.3:3.8:2.8. It was noted that the average of 32 possible players for the India team was 3.6:4. l:2.9, and that of 16 players for the Pakistan team was 2.8:4.3:2.5.

Olympic players from other leading countries were more mesomorphic than Asian players, as were players from high-level club teams from South Africa (2.2:5.3:2.3) studied by Scott (10). The *full-backs* of the national teams of India and Pakistan were defined as mesoendomorphic (15).

The goalkeeper of the provincial teams of India (11) was the most endomorphic and the least mesomorphic.

The value for mesomorphism at this level was higher among defenders, but forwards and midfielders were close to them. In this respect there seems to be a tendency in elite hockey players towards mesomorphism, and away from ectomorphism.

Similar values were found in the Witriw study, where the body composition of 28 elite male field hockey players (16) was determined, showing a somatotype of 3.25:4.10:1.97.

In this study it was observed that the players presented a significant increase in skeletal and muscle mass relating them to the sedentary population (Phantom) and a decrease in fat mass, as expected for most sports.

In relation to the reserves, it has been described that the men's team presented in 25% of its members a diminished protein reserve, a situation that possibly weighs on their performance.

The diameters of wrist, humerus, femur and ankle were significantly larger than the sedentary population ($p = 0.000$), as well as height (0.000), sitting height (0.033) and weight (0.000).

In relation to the perimeters, those that presented significant differences were relaxed biceps (0.000) and contracted (0.000), thorax (0.000), thigh (0.000) and twin (0.000). (16)

In this sense, the study of body composition by means of NFNS® becomes relevant, since it not only allows us to know the nutritional status of the subject under study, but also to select the most appropriate sports modality for the subject's body characteristics, determine the somatotype, (17) as well as to evaluate the effectiveness of a training program and / or a specific nutritional intervention.

1.2 ALTERNATIVE USE OF SUPPLEMENTS

In sports practice it is common for the player to want to increase their muscle mass by increasing strength and / or endurance, with improved performance. Because of this, many athletes seek different exogenous aids, including protein supplements (SP).

An example of its use is the study of a population (n = 412) from southern Chile, which attends gyms recreationally, where it was seen that 22% used some type of dietary supplement, the most preferred was the SP (36%). It was also observed that the majority (57%) of the subjects who consumed some types of supplements were male. (18)

On the other hand, a study conducted in Seville, Spain, evaluated the consumption of nutritional and dietary supplements in the population.

For this, people who regularly attended gyms were selected, the sample (n = 415) was made up of 260 men and 155 women from 4 gyms in that city.

Of the total of the same, 56.14% have consumed on some occasion some supplement being the most consumed in decreasing order Proteins (28%), L-Carnitine (18.6%), Sports Drink (18.3%), Creatine (17.1%) and Vitamin Complex (17.1%). (19)

Many are the supplements that are currently marketed and assert that they can collaborate with the much-desired increase in muscle mass by athletes, however, not all the research work carried out could prove its effectiveness. (20)

Different studies comparing the effects of SPs with carbohydrate-based supplements (CHOs) have shown that SPs resulted in greater increases in total body mass, lean mass, or muscle strength. (21) (22) (23).

On the contrary, others show that SP does not result in a significant increase in lean mass, except for those made using some specific supplements such as creatine and HMB (20), while others showed greater results in increasing muscle mass and strength with CHO supplementation over those obtained by SP (24) or through the use of the Mediterranean diet. (24)

To maintain muscle mass, it is necessary that there is a balance between protein intake, and protein degradation. When looking to increase muscle mass, the nitrogen balance must be positive: excess nitrogen is retained and used for tissue synthesis.

Physical exercise also plays a fundamental role in muscle growth, its effect being variable according to the various types of training, intensity, level of previous training, hormonal stimuli and the composition of the diet.

This also generates a high rate of degradation, which must be compensated with a correct protein intake.

Some studies suggest that muscle growth may be influenced by hormones such as insulin, testosterone, growth hormone and cortisol, however they do not show significant results regarding the influence they generate on muscle synthesis in healthy individuals in in vivo studies, with the exception of testosterone, studied by Bhasin et al, who have recently demonstrated an unequivocal effect on the increase in muscle size and strength, in non-exercised individuals compared to the effects obtained by placebo injections. (25)

It is also necessary to adapt the recommendations of this macronutrient according to the type of sports activity performed, since the requirements are different between the different types of sports activities. In general, the protein recommendation for endurance athletes is 1.2 to 1.4 g/kg body weight per day and 1.6 to 1.8 g/kg body weight per day for strength exercises. (26).

2 MATERIAL AND METHODS

Therefore, it was proposed to determine the Body Composition and Nutritional Diagnosis by the ENFA method of synthetic field hockey players of the first division and determine the comparison of body composition according to® the food plan carried out.

For this purpose, it was used the ENFA® method for the evaluation of the body composition of the population to be studied to know not only the components, the somatotype and the distribution profile of measures but also the nutritional diagnosis through the Protein Reserve and the Caloric Reserve.

It presents the characteristics of safety, reproducibility, feasibility and low operating cost. (27)(28)(29) 14 male synthetic field hockey players from the upper team of Club Ferrocarril Mitre (first and intermediate division) located in the city of San Martín in the province of Buenos Aires, Argentina, who performed physical training twice a week for 120 minutes, based on intermittent activity (mainly resistance exercises and some explosives), were evaluated.

And that, in addition, once a week they performed 90 minutes of strength exercises and plyometrics in the gym according to what was dictated by their physical trainer and use of bicycle as a muscle relaxation activity. The type of diet was evaluated by means of a structured survey.

All study participants signed informed consent. 25 surface measurements were taken to perform the ENFA® method by trained and standardized anthropometrist.

These measurements taken were: Weight, Height, Seated height, Skin folds (tricipital, bicipital, subscapular, suprailiac, abdominal, thigh, calf), Bone diameters (humerus, wrist, femur, ankle, biacromial, anteroposterior thorax, biiliac, bitrocantéreo) and Perimeters (relaxed biceps, contracted biceps, forearm, thorax, abdomen, thigh, calf).

The following measuring instruments were used: It was used for seated size (bench of 40 cm) altimeter of frontal reading wall brand Seca, for the short diameters short anthropometer brand Cescorf and Collins pelvimeter for long diameters, for the folds plicometer brand Cescorf, for the perimeters metric tape brand Cescorf and for the digital weight scale brand Silfab. All measurements were performed by subjects trained and standardized in anthropometry.

With these measurements, the sum of 5 components (in kg and percentages) was determined: fat, skeletal, visceral, muscular and residual mass (difference between the actual weight and that calculated according to the sum of masses). The values were obtained through the following formula:

$$M=(Z*s+P) / (Tph / Ts)3 \quad (1)$$

V= variable value
Tph=size Phantom
Ts= Subject size
P= ph value of the variable
S= offset of V
Z= z means of Phantom proportionality scores

With these data, the protein and caloric body reserves were obtained to determine the nutritional diagnosis of the subject.

The first arises from the relationship between muscle mass and skeletal mass, and the second between fat and skeletal mass.

This is how it is possible to obtain a value of normality and its deviations when using the measurements of the model Phantom (reference population that synthesizes human proportionality, based on the measurement of 23,512 people worldwide, between 6 and 69 years old, which provides an average value and its corresponding deviation for each of the surface measurements). (28) (29).

Table 1: Classification of diagnosis

	HEAT RESERVE	PROTEIN RESERVE
Average value	1,16	2,43
Normality Range (±2 ds)	0.85 to 1.47	2,15 a 2,72
Moderate decrease (-2 to -3 ds)	0,54 a 0,84	1,87 a 2,71
Severe Decrease (< - 3 ds)	< a 0,54	< a 1,87
Moderate Increase (+2 to +3 ds)	1,48 a 1,78	
Severe Increase (> to + 3)	> a 1,78	

The calculation of the mathematical anthropometric somatotype of Heath-Carter was also carried out... Somatotype values are expressed in a somatochart, where the three values (three-dimension) converge at one point (two-dimensional) using X-Y coordinates. Thus: X= Ectomorph-Endomorph

Y=2 x Mesomorph – (Endomorph – Ectomorph)

In addition, the food plan was evaluated and categorized as follows:

❖ Group A: subjects who make a food plan without consumption of supplements that are assessed anthropometrically at two months using the same plan

❖ Group B: subjects who make a food plan with protein consumption and who are assessed anthropometrically after two months maintaining the same plan.

❖ Group C: subjects who did not consume protein supplements and begin to do so and are assessed anthropometrically at two months.

Descriptive anthropometric data were calculated according to the location on the field of play (defenders, midfielders and forwards) with the Statistic. The median of the equipment was compared with the values of the Phantom (Reference Population) by means of the Sign Test. Differences in masses were calculated by applying the sign test for paired samples.

3 RESULTS

Table 2: Comparison of Measured Diameter Values with the Phantom model.

Diameter Measurements	Measured values (Kg) (X± ds)	Phantom Value (Kg) (X± ds)	P value
Wrist	6.07±0.24	5.21±0.28	0.0001
Humerus	7.24±0.36	6.48±0.35	0.0001
Femur	9.82±0.35	9.52±0.48	0.057 NS
Ankle	7.82±0.33	6.68±0.36	0.0001

Table 3: Comparison of Body Masses with the Phantom model.

Body Masses (kg)	Measured values (X± ds)	Phantom Value (X± ds)	P value
Fat Mass	7.38±1.62	12.13±3.25	0.0001
Skeletal Mass	14.34±1.52	10.49±1.57	0.0001
Muscle Mass	32.46±3.95	25.55±2.99	0.0018

There were no significant differences in relation to height (p=0.17) or sitting height (p=0.179), when compared with the Phantom model.

Significant differences (higher values) were found for the variables: weight (p=0.013), forearm circumference (p=0.013), humeral diameter (p=0.0001), wrist diameter (p=0.0001), ankle diameter (p=0.0001), muscle mass (p=0.0018), and skeletal mass (p=0.0001) and minus value for fat mass (p=0.0001).

Table 4: Descriptive statistics for men's hockey defenders (N=6).

Variables	Median	DS	Minimal	Maximum
Size (cm)	178.60	11.63	163.80	195.00
Seated size (cm)	93.53	6.91	84.100	105.00
Long. Lower Limbs (cm)	85.06	6.12	79.500	93.000
Weight (Kg)	79.98	11.73	66.400	98.200
M Skeletal	14.76	2.68	12.03	19.56
M Fat	8.27	1.55	6.58	10.29
M Muscular	35.01	6.12	28.54	44.49
M Residual	2.76	1.88	0.02	5.17
RP	2.39	0.13		
RC	0.56	0.07		

Table 5: Descriptive statistics for men's hockey flyers (N=2).

Variables	Median	DS	Minimal	Maximum
Size (cm)	169.10	9.05	162.70	175.50
Sitting size (cm)	89.45	2.05	88.00	90.90
Long. Lower limbs	79.65	7.00	74.70	84.60
Weight (Kg)	73.600	5.65	69.60	77.60
M Skeletal	13.24	2.84	11.23	15.25
M Fat	9.145	3.35	6.77	11.52
M Muscular	31.25	2.44	29.52	32.98
M Residual	4.19	5.04	0.620	7.76
RP	2.39	0.23		
RC	0.68	0.08		

Table 6: Descriptive statistics for men's hockey forwards (N=6).

Variables	Median	DS	Minimal	Maximum
Size (cm)	173.20	7.18	162.00	183.30
Seated size (cm)	91.25	2.85	88.70	95.30
Long. Lower limbs	81.95	5.64	72.00	88.00
Weight (Kg)	68.53	8.22	57.00	78.30
M Skeletal	14.29	1.37	12.64	16.29
M Fat	5.91	1.40	3.89	7.76
M Muscular	30.32	4.30	23.97	36.98
M Residual	1.89	1.87	0.040	3.70
RP	2.12	0.17		
RC	0.41	0.06		

Table 7: Somatotype of male hockey defenders (N=6).

Variable	Median	SD	Minimal	Maximum
ENDO	2.84	0.58	2.07	3.58
MEAT	4.75	1.05	3.76	6.39
ECTO	1.89	0.97	0.75	3.28

Table 8: Somatotype of men's hockey flyers (N=2).

Variable	Median	DS	Minimal	Maximum
ENDO	3.92	1.37	2.95	4.89
MEAT	5.78	0.07	5.73	5.84
ECTO	1.11	0.60	0.68	1.54

Table 9: Somatotype of men's hockey forwards (N=6).

Variable	Median	DS	Minimal	Maximum
ENDO	2.20	0.63	1.22	3.23
MEAT	4.73	1.04	3.18	6.16
ECTO	2.44	0.61	1.76	3.45

Table 10: Comparison of the sample that performs usual plan without addition of protein supplements (Group A).

Shows that you did not change your eating plan	Body Mass (kg) 1st measurement (X ± ds)	Body Mass(kg) 2nd measurement (X ± ds)	P value
N=4	Fat Mass 9.29 ± 2.58	Fat Mass 9.07 ± 2.71	0.72 NS
N=4	Muscle Mass 36.42 ± 6.88	Muscle Mass 36.73 ± 7.66	0.52 NS
N=4	Residual Mass 0.71 ± 0.64	Residual Mass 1.11± 0.87	0.30 NS

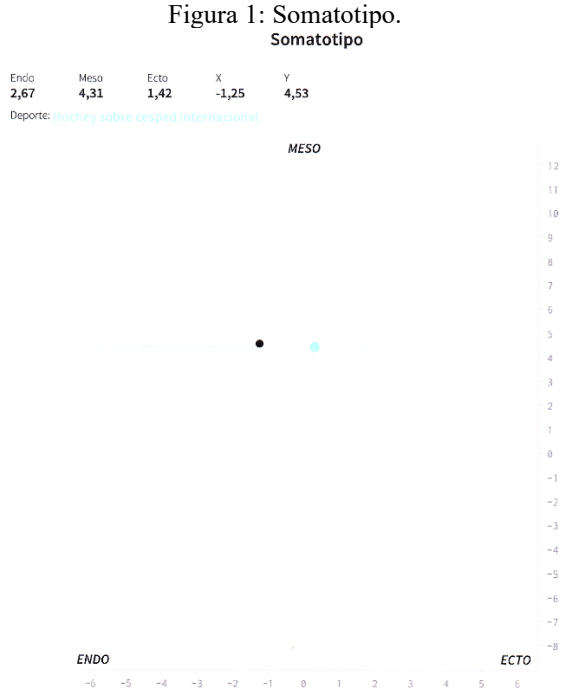
Table 11: Comparison of the sample that did not modify its dietary plan by consuming protein supplements (Group B).

Shows that you did not modify your eating plan by taking protein supplements	Body Mass (kg) 1st measurement (X ± ds)	Body Mass (kg) 2nd measurement (X ± ds)	P value
N=5	Fat Mass 7.27 ± 0.89	Fat Mass 7.47 ± 1.53	0.62 NS
N=5	Muscle Mass 31.6 ± 3.71	Muscle Mass 32.19 ± 3.69	0.10 NS
N=5	Residual Mass 4.13 ± 2.81	Residual Mass3.64 ± 3.09	0.22 NS

Table 12: Comparison of the sample that did not consume protein supplements habitually and begins to consume them (Group C).

Shows that he did not consume protein supplements regularly and begins to consume them	Body Mass(kg) 1st measurement (X ± ds)	Body Mass(kg) 2nd measurement (X ± ds)	P value
N=5	Fat Mass 5.99 ± 1.56	Fat Mass 6.09 ± 1.45	0.35 NS
N=5	Muscle Mass 30.17 ± 4.06	Muscle Mass 31.06 ± 3.99	0.05
N=5	Residual Mass 2.58 ± 1.58	Residual Mass 2.24 ± 1.18	0.34 NS

Figura 1: Somatotipo.



4 CONCLUSIONS

Significant differences were found in relation to the Phantom Reference Population in the following variables:

Larger humerus diameter (p=0.0001), larger wrist diameter (p=0.0001), larger ankle diameter (p=0.0001), greater amount of muscle mass (p=0.0018), and greater skeleton (p=0.0001), and smaller amount of fat mass (p=0.0001). The defenders presented higher average height, sitting height, muscle mass and skeletal mass. The forwards had less average weight and less fat mass. The flyers had a lower skeletal mass.

In relation to the Somatotype: both the endomorphic and mesomorphic components had higher values in midfielders, followed by defenders and then forwards, while greater ectomorphism was observed in forwards, followed by defenders and with the lowest values in midfielders.

The average values found for Forwards in relation to endo, meso and ecto, were respectively: (2.20/4.73/2.44), for Defenders: (2.84/4.75/1.89) and for Flyers (3.92/5.78/1.11).

LAfter 2 months, significant differences (p=0.05) were found in body composition regarding muscle mass in group C (players who did not consume protein supplements and began to do so at the time of the first body composition assessment).

It should be noted that the other groups did not make changes to their usual food plan, so the results coincide with this characteristic.

It is suggested to continue with this line of study to determine if it is possible to increase muscle mass with proper training and eating plan and if that increase is significant.

If so, the use of food plans would be preferred without having to resort to supplements to achieve an increase in muscle mass.

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