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Health Concerns and Talented Sportspersons Identification Derivable from Height, Weight, Body Mass Index and Ectomorphy Rating Mean Values in Democratic Republic of the Congo (DRC) 2016-2017

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Abstract

During the academic year 2016-2017, students aged 18 years and older in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty have shown the following mean values, respectively of, cm height, kg weight, $kg \cdot m^{-2}$ BMI and unit-less ectomorphy: 1˚ non-sportsmen: 173.4 cm, 55.8 kg, 18.6 $kg \cdot m^{-2}$, and 4.8; 2˚ sportsmen: 174.2 cm, 63.6 kg, 20.9 $kg \cdot m^{-2}$, and 3.5; 3˚ non-sportswomen: 162.2 cm, 59.4 kg, 22.6 $kg \cdot m^{-2}$, and 2.2; 4˚ sportswomen: 161.5 cm, 52.4 kg, 19.9 $kg \cdot m^{-2}$, and 3.2; 5˚ all males students: 173.8 cm, 62.7 kg, 20.7 $kg \cdot m^{-2}$, and 3.6; 6˚ all female students: 160.4 cm, 54.5 kg, 20.6 $kg \cdot m^{-2}$, and 2.6; 7˚ all male and female students pulled together: 168.1 cm, 59.1 kg, 20.6 $kg \cdot m^{-2}$, and 3.2. Sports practice seems to increase in males but to decrease in females, height, weight and BMI; while it seems to decrease in males but to increase in females, ectomorphy rating. Sports practice could improve health situation of the population which is bad (14.4% of underweight BMI values instead of less than 5.0%). DRC is worth looking for the mean weight of the subjects enrolled in the experimentation that led to the direction for use adult recommended dose of each imported drug so as, if need be, to adapt it to DRC residents. Referencing values published by others have helped give examples of recruiting sportspersons so as to expect training to be rapidly successful and to expect sports practitioners to be at their best performance during competitions.

Subject Areas

Mathematical Biology

Keywords

Body Mass Index, Democratic Republic of the Congo, Ectomorphy Rating, Health Concerns, Height, Pharmacovigilance, Sport, Talent Identification, Weight

1. Introduction

The present article focuses on four anthropometric variables: height, weight, body mass index (BMI) and ectomorphy rating. The value of each of the two latter is related to the value of each of the two former. The article is aimed to find out the 1˚ mean values of, and 2˚ possible influences of the four anthropometric variables in Democratic Republic of the Congo (DRC) residents from the standpoints of health concerns and sportspersons talent identification.

1.1. Health Concerns

a) *Height*

Identification of some disease risks may rely on computation of BMI, a variable which requires the knowledge of the concerned subject's not only weight but also height.

b) *Weight*

According to Schmitt [1], as drug doses necessary to produce a given effect are a function of the patient weight, while dealing with experimentation, dose is always related to body mass kilograms. A child must be administered only a fraction of the amount of drug to be administered to the adult. Comparing to dosages based on the age of the child, the dosages based on his weight give the most exact results [2]. Moreover (see *a. Height*), the knowledge of weight is indispensable for computing BMI.

c) *Body Mass Index*

BMI is used to assess weight relative to height and its knowledge is useful for the identification, evaluation, as well as treatment of overweight and obesity in adults [3]. BMI knowledge is also useful for the identification of normal weight as well as the identification and evaluation of underweight [4].

1.2. Sportspersons Talent Identification

It has been suggested that efficient talent identification procedures play a very important role in modern sport and were a major factor in Eastern Europe's domination of many Olympic sports during the 1970s and 1980s [5]. In general, the tendency has been toward more similar physiques within sports but toward very different physiques between sports [6]. As physiques fit for some sports and not for others, it is interesting to find out where DRC residents physiques fit the better in sports practice. As a matter of fact, below mentioned examples support the idea that [7] there exist racial types whose physiques are highly suitable for

certain sports or events within those sports.

a) *Height* [6]

To make supply match demand of suitable height, there have been more and more Hispanic and Asian jockeys, as well as fewer and fewer Caucasians marathoners. In August 2001, 18 of the fastest 20 male marathon times and 13 of the fastest female times were by East Africans and Japanese.

b) *Height and Weight*

Accurate forecasts with relation to the individual and team performances can be made on the basis of measurements of height and body mass alone [5].

c) *Body Mass Index*

BMI could probably influence sport performance, as 1˚ it assesses weight to height and 2˚ under-height as well as underweight have been associated with decreased capacity in migrant agricultural workers to Brazil [4].

d) *Ectomorphy rating*

Malina and Bouchard have suggested that ectomorphy was reasonably stable during growth but that mesomorphy and endomorphy in adolescent boys were not as predictable [5]. On the other hand, ectomorphy rating is also another variable that assesses weight to height. It is not thus unsound to expect it help forecast accurately performance of sports practitioners (see *b. Height and Weight*).

2. Material and Methods

2.1. Human Material

Male and female students aged 18 years and older in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty have been invited to provide information whether they were practicing at least one sport or not. Students' height and weight have been measured over a four-academic year period (2013-2014, 2014-2015, 2015-2016, and 2016-2017).

2.2. Inanimate Material

Students' height have been measured using a wall height gauge, divisions of which ranged from 0 to 200 cm, each division measuring 0.1 cm. Students' weight have been measured using an electronic personal scale, divisions of which ranged from 0 to 150 kg, each division measuring 0.1 kg.

2.3. Methods

a) *Counts, arithmetic means and variances*

Microsoft Office Excel 2010 program has been used to count the number of values (n) as well as to compute the arithmetic mean ($\bar{x}$) and variance (s^2) related to each population (sportspersons, non-sportspersons, …) concerned variable (height, weight, BMI, ectomorphy rating); and to compute percentages of each population subjects whose BMI values fall in any of WHO BMI cutoffs.

b) *BMI*

BMI have been calculated by dividing body weight in kilograms by squared

height in meters ($kg \cdot m^{-2}$) [3].

c) *Ectomorphy rating*

As signaled by the author [8], ectomorphy may be rated using the Heath-Carter somatotype rating form [9]. Equations may also be used with the same purpose [10]. They have been used in the present study (Equations (1) to (4), just below).

Rating ectomorphy by equations uses the height-weight ratio (HWR) as given by Equation (1). Taking into account the HWR, ectomorphy is rated according to Equation (2) if HWR > 40.75, according to Equation (3) if HWR is included in the interval [38.28 - 40.75], and according to Equation (4) if HWR < 38.28.

$$\text{HWR} = \frac{\text{Height}}{\sqrt[3]{\text{Weight}}} \tag{1}$$

$$\text{Ectomorphy} = \left(\text{HWR} \times 0.732\right) - 28.58 \tag{2}$$

$$\text{Ectomorphy} = \left(\text{HWR} \times 0.463\right) - 17.63 \tag{3}$$

$$\text{Ectomorphy} = 0.1 \tag{4}$$

In the Equation (4), 0.1 is the value arbitrarily given to each of the cases where HWR is < 38.28.

d) *Comparison of samples means*

Comparison has been dealt with between pairs of samples means of the variables height, weight, BMI and ectomorphy rating. Each sample has been considered small because in each comparison, there has been at least one small sample (n < 30). Population variances have been assumed to be equal because in each pair of means, one concerned non-sportspersons while the other concerned sportspersons, all of them belonging to the same population of students aged 18 years and over, in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty.

The variance of the difference between sample mean$_1$ and sample mean$_2$ (s_c^2) has been computed as [11]

$$s_c^2 = \frac{\left[\Sigma X_1^2 - \frac{\left(\Sigma X_1\right)^2}{N_1} + \Sigma X_2^2 - \frac{\left(\Sigma X_2\right)^2}{N_2}\right]}{N_1 + N_2 - 2} \tag{5}$$

where ΣX_1^2 is the mean of the squared values of the sample$_1$, ΣX_2^2 is the mean of the squared values of the sample$_2$, $\left(\Sigma X_1\right)^2$ is the square of the sum of all the values of sample$_1$, $\left(\Sigma X_2\right)^2$ is the square of the sum of all the values of sample$_2$, N_1 is the number of the values of sample$_1$, N_2 is the number of the values of sample$_2$, and $N_1 + N_2 - 2$ represents the degrees of freedom of the Student's 't' statistic.

The Student's "t" statistic has been computed as [11]

$$t = \frac{\bar{X}_1 - \bar{X}_2}{s_c \sqrt{\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}} \tag{6}$$

where $\overline{X}_1$ is the arithmetic mean of all the values of sample$_1$, and $\overline{X}_2$ is the arithmetic mean of all the values of sample$_2$.

The Student's "t" statistics and the related degrees of freedom helped to pronounce about possible significance levels of the differences of means.

3. Results

Tables 1-6 are related to male and female students in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty. Those tables are the result of measuring the students height and weight over a four-academic year period (2013-2014, 2014-2015, 2015-2016 and 2016-2017), and then computing BMI, ectomorphy rating as well as the means values and variances of the four anthropometric variables.

Table 1. Anthropometric values shown by male students aged 18 years and older in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty.

Academic Year	Height (cm)			Weight (kg)			Body Mass Index (kg·m^{-2})			Ectomorphy Rating (unitless)		
	n	$\overline{x}$	s^2	n	$\overline{x}$	s^2	n	$\overline{x}$	s^2	n	$\overline{x}$	s^2
2013-2014												
a	-	-	-	-	-	-	-	-	-	-	-	-
b	16	170.8	17.9	16	61.4	69.6	16	21.1	8.9	16	3.3	1.4
c	25	169.5	78.6	24	62.5	64.4	24	21.6	4.8	24	2.9	1.4
d	41	170.0	54.3	40	62.1	65.0	40	21.4	6.3	40	3.0	1.4
2014-2015												
a	31	172.3	60.6	30	60.2	64.9	24	20.8	7.1	24	3.4	1.5
b	6	169.5	11.8	6	57.8	14.3	6	20.1	1.5	6	3.5	0.5
c	27	170.7	45.6	28	58.4	42.8	27	20.1	2.6	27	3.7	1.0
d	64	171.4	49.6	64	59.2	50.2	57	20.4	4.4	57	3.5	1.1
2015-2016												
a	4	171.0	12.8	4	63.1	38.7	4	21.6	2.5	4	2.9	0.5
b	23	171.9	34.5	22	59.6	53.8	22	20.0	3.3	22	3.8	0.9
c	26	171.9	74.9	22	61.1	67.9	22	20.5	5.3	22	3.6	1.9
d	53	171.8	51.4	48	60.6	57.9	48	20.4	4.2	48	3.6	1.3
2016-2017												
a	3	169.5	4.2	2	56.5	29.6	2	19.7	1.6	2	3.7	0.3
b	6	173.4	59.1	4	55.8	31.2	4	18.6	9.2	4	4.8	6.3
c	47	174.2	37.9	45	63.6	68.7	45	20.9	5.7	45	3.5	1.6
d	56	173.8	38.3	51	62.7	69.0	51	20.7	6.0	51	3.6	2.0

a relates to the students who failed to provide the information whether they were practicing at least one sport or not; b relates to the students who declared themselves not to be sportspersons; c relates to the students who declared themselves to be practitioners of at least one sport; d relates to male students, independently of whether they have pronounced themselves about their participation in sports activities or not; n relates to the number of subjects concerned by a variable value measurement or computation; $\overline{x}$ relates to the arithmetic mean of the values of a variable measured in the concerned subjects or computed from the values measured in those subjects; s^2 relates to the variance shown by the concerned values about their mean.

Table 2. Anthropometric values shown by female students aged 18 years and older in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty.

Academic Year	Height (cm)			Weight (kg)			Body Mass Index (kg·m^{-2})			Ectomorphy Rating (unitless)		
	n	$\bar{x}$	s^2	n	$\bar{x}$	s^2	n	$\bar{x}$	s^2	n	$\bar{x}$	s^2
2013-2014												
a	-	-	-	-	-	-	-	-	-	-	-	-
b	17	159.6	26.1	17	58.7	115.9	17	23.0	15.6	17	1.9	1.9
c	3	162.3	65.1	3	63.1	23.9	3	24.0	1.1	3	1.4	0.5
d	20	160.0	29.9	20	59.3	102.8	20	23.2	13.4	20	1.8	1.7
2014-2015												
a	10	161.1	32.0	13	56.3	39.9	9	21.2	3.4	9	2.5	0.6
b	11	160.9	34.6	14	54.7	111.8	11	20.6	9.9	11	2.8	1.8
c	10	161.0	34.9	12	58.3	46.1	10	22.6	5.5	10	1.9	1.1
d	31	161.0	31.6	39	56.3	66.3	30	21.4	6.8	30	2.4	1.3
2015-2016												
a	9	160.1	25.4	10	58.7	24.4	9	23.2	2.3	9	1.5	0.5
b	18	158.3	42.6	17	52.3	99.6	16	21.1	17.9	16	2.7	3.3
c	5	162.4	163.7	5	53.7	33.2	5	20.5	6.2	5	3.0	2.8
d	32	159.4	53.4	32	54.5	71.3	30	21.6	11.9	30	2.4	2.6
2016-2017												
a	15	1577	47.1	14	51.8	59.6	15	19.4	36.1	14	2.5	2.3
b	14	162.2	23.9	13	59.4	123.3	13	22.6	14.9	13	2.2	2.3
c	13	161.5	72.8	12	52.4	51.5	12	19.9	2.3	12	3.2	0.9
d	42	160.4	49.1	39	54.5	86.7	40	20.6	20.2	39	2.6	1.9

a relates to the students who failed to provide the information whether they were practicing at least one sport or not; b relates to the students who declared themselves not to be sportspersons; c relates to the students who declared themselves to be practitioners of at least one sport; d relates to female students, independently of whether they have pronounced themselves about their participation in sports activities or not; n relates to the number of subjects concerned by a variable value measurement or computation; $\bar{x}$ relates to the arithmetic mean of the values of a variable measured in the concerned subjects or computed from the values measured in those subjects; s^2 relates to the variance shown by the concerned values about their mean.

Table 3. Anthropometric values shown by pulled together male and female students aged 18 years and older in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty.

Academic Year	Height (cm)			Weight (kg)			Body Mass Index (kg·m^{-2})			Ectomorphy Rating (unitless)		
	n	$\bar{x}$	s^2	n	$\bar{x}$	s^2	n	$\bar{x}$	s^2	n	$\bar{x}$	s^2
2013-2014												
e	61	166.7	68.1	60	61.2	77.8	60	22.0	9.2	60	2.6	1.8
2014-2015												
e	95	168.0	67.0	103	58.1	57.7	87	20.7	5.4	87	3.2	1.4
2015-2016												
e	85	167.2	87.8	80	58.2	71.3	78	20.8	7.4	78	3.2	2.1
2016-2017												
e	98	168.1	87.4	90	59.1	92.3	91	20.6	12.1	90	3.2	2.2

e relates to all the subjects, males and females, concerned by an academic year; n relates to the number of subjects concerned by a variable value measurement or computation; $\bar{x}$ relates to the arithmetic mean of the values of a variable measured in the concerned subjects or computed from the values measured in those subjects; s^2 relates to the variance shown by the concerned values about their mean.

The coming discussion is concerned mainly with the 2016-2017 academic year results, as height, weight, BMI and ectomorphy rating are likely to vary according to the passing of the years. However, 2013-2014, 2014-2015 and 2015-2016 academic year results are presented so as to serve in the evaluation of possible secular trends of the four anthropometric variables, after some years.

The students have been invited to provide the information whether they were practicing at least one sport or not. Some of the students failed to provide the expected information (a, in the Tables), some declared themselves not to be sportspersons (b, in the Tables), while others declared themselves to be practitioners of at least one sport (c, in the Tables). In any table, "d" refers to all the subjects of the same gender, independently of whether they have pronounced themselves about their participation in sports activities or not, while "e" refers to all the subjects, males and females, concerned by a given academic year. Some students have been absent when has been measured a variable, either height or weight. That affects the values of the variables computed from height and weight (BMI and ectomorphy rating).

3.1. Health Concerns

a) *Morbidity and Mortality Concerns*

Pulling together the variables values referred to the 2016-2017 students aged 18 years and older, in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty, mean height ± variance has been 173.8 ± 38.3 cm in the 56 male subjects (Table 1) and 160.4 ± 49.1 in the 42 female subjects (Table 2); mean weight ± variance has been 62.7 ± 69.0 kg in the 51 male subjects (Table 1) and 54.5 ± 86.7 kg in the 39 female subjects (Table 2).

Pulling together the variables values referred to the 2016-2017 students who declared themselves not to be sportspersons, aged 18 years and older, in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty, mean BMI ± variance has been 18.6 ± 9.2 $kg{\cdot}m^{-2}$ in the 4 male subjects (Table 1) and 22.6 ± 14.9 $kg{\cdot}m^{-2}$ in the 13 female subjects (Table 2).

Tables 4-6 speak of underweight, normal, overweight and class I obesity percentages, in accordance with what follows. Stated in $kg{\cdot}m^{-2}$, a BMI value inferior to 18.5 is that of a subject suffering from underweight; a BMI value lying between 18.5 and 24.9 is normal; a BMI value lying between 25.0 and 29.9 is that of a subject suffering from overweight; a BMI value lying between 30.0 and 34.9 is that of a subject suffering from class I obesity; a BMI value lying between 35.0 and 39.9 is that of a subject suffering from class II obesity; while a BMI value superior or equal to 40.0 is that of a subject suffering from class III obesity [3].

Tables 4-6 show that the academic year 2016-2017, in male and female students aged 18 years and older, in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty.

1° in male subjects (Table 4, 2016-2017), a° BMI lies between 18.5 $kg{\cdot}m^{-2}$ and 24.9 $kg{\cdot}m^{-2}$ in 100.0% of subjects who did not pronounce themselves about their

participation in sports activities; b˚ BMI lies below 18.5 $kg{\cdot}m^{-2}$ in 25.0% of subjects who declared themselves not to be sportspersons; c˚ BMI lies between 18.5 $kg{\cdot}m^{-2}$ and 24.9 $kg{\cdot}m^{-2}$ in 75.0% of subjects who declared themselves not to be sportspersons; d˚ BMI lies below 18.5 $kg{\cdot}m^{-2}$ in 15.6% of subjects who declared themselves to be sportspersons; e˚ BMI lies between 18.5 $kg{\cdot}m^{-2}$ and 24.9 $kg{\cdot}m^{-2}$ in 77.8% of subjects who declared themselves to be sportspersons; f˚ BMI lies between 25.0 $kg{\cdot}m^{-2}$ and 29.9 $kg{\cdot}m^{-2}$ in 6.7% of subjects who declared themselves to be sportspersons; g˚ BMI lies below 18.5 $kg{\cdot}m^{-2}$ in 15.7% of all the subjects of the male gender, independently of whether they have pronounced themselves about their participation in sports activities or not; h˚ BMI lies between 18.5 $kg{\cdot}m^{-2}$ and 24.9 $kg{\cdot}m^{-2}$ in 78.4% of all the subjects of the male gender, independently of whether they have pronounced themselves about their participation in sports activities or not; i˚ BMI lies between 25.0 $kg{\cdot}m^{-2}$ and 29.9 $kg{\cdot}m^{-2}$ in 5.9% of all the subjects of the male gender, independently of whether they have pronounced themselves about their participation in sports activities or not.

2˚ in female subjects (Table 5, 2016-2017), a˚ BMI lies below 18.5 $kg{\cdot}m^{-2}$ in 14.3% of subjects who did not pronounce themselves about their participation in sports activities; b˚ BMI lies between 18.5 $kg{\cdot}m^{-2}$ and 24.9 $kg{\cdot}m^{-2}$ in 78.6% of subjects who did not pronounce themselves about their participation in sports activities; c˚ BMI lies between 25.0 $kg{\cdot}m^{-2}$ and 29.9 $kg{\cdot}m^{-2}$ in 7.1% of subjects who did not pronounce themselves about their participation in sports activities; d˚ BMI lies below 18.5 $kg{\cdot}m^{-2}$ in 15.4% of subjects who declared themselves not to be sportspersons; e˚ BMI lies between 18.5 $kg{\cdot}m^{-2}$ and 24.9 $kg{\cdot}m^{-2}$ in 61.5% of subjects who declared themselves not to be sportspersons; f˚ BMI lies between 25.0 $kg{\cdot}m^{-2}$ and 29.9 $kg{\cdot}m^{-2}$ in 15.4% of subjects who declared themselves not to be sportspersons; g˚ BMI lies between 30.0 $kg{\cdot}m^{-2}$ and 34.9 $kg{\cdot}m^{-2}$ in 7.7% of subjects who declared themselves not to be sportspersons; h˚ BMI lies below 18.5 $kg{\cdot}m^{-2}$ in 8.3% of subjects who declared themselves to be sportspersons; i˚ BMI lies between 18.5 $kg{\cdot}m^{-2}$ and 24.9 $kg{\cdot}m^{-2}$ in 91.7% of subjects who declared themselves to be sportspersons; j˚ BMI lies below 18.5 $kg{\cdot}m^{-2}$ in 12.8% of all the subjects of the female gender, independently of whether they have pronounced themselves about their participation in sports activities or not; k˚ BMI lies between 18.5 $kg{\cdot}m^{-2}$ and 24.9 $kg{\cdot}m^{-2}$ in 76.9% of all the subjects of the female gender, independently of whether they have pronounced themselves about their participation in sports activities or not; l˚ BMI lies between 25.0 $kg{\cdot}m^{-2}$ and 29.9 $kg{\cdot}m^{-2}$ in 7.7% of all the subjects of the female gender, independently of whether they have pronounced themselves about their participation in sports activities or not; m˚ BMI lies 30.0 $kg{\cdot}m^{-2}$ and 34.9 $kg{\cdot}m^{-2}$ in 2.6% of all the subjects of the female gender, independently of whether they have pronounced themselves about their participation in sports activities or not.

3˚ in male and female subjects pulled together (Table 6, 2016-2017), a˚ BMI lies below 18.5 $kg{\cdot}m^{-2}$ in 14.4% of subjects; b˚ BMI lies between 18.5 $kg{\cdot}m^{-2}$ and 24.9 $kg{\cdot}m^{-2}$ in 77.8% of subjects; c˚ BMI lies between 25.0 $kg{\cdot}m^{-2}$ and 29.9 $kg{\cdot}m^{-2}$ in 6.7% of subjects; d˚ BMI lies between 30.0 $kg{\cdot}m^{-2}$ and 34.9 $kg{\cdot}m^{-2}$ in 1.1% of

subjects

b) *Pharmacovigilance Concerns*

As signaled above, pulling together the variables values referred to all the 2016-2017 students (Table 1 and Table 2), mean weight ± variance has been 62.7 ± 69.0 kg in the 51 male subjects and 54.5 ± 86.7 kg in the 39 female subjects.

3.2. Sport Talent Identification

Pulling together the variables values referred to the 2016-2017 students who declared themselves not to be sportspersons (Table 1 and Table 2), 1˚ mean height ± variance has been 173.4 ± 59.1 cm for in the 6 male subjects and 162.2 ± 23.9 in the 14 female subjects; 2˚ mean weight ± variance has been 55.8 ± 31.2 kg in the 4 male subjects and 59.4 ± 123.3 kg in the 13 female subjects; 3˚ as signaled above, mean BMI ± variance has been 18.6 ± 9.2 $kg{\cdot}m^{-2}$ in the 4 male subjects and 22.6 ± 14.9 $kg{\cdot}m^{-2}$ in the 13 female subjects; 4˚ mean ectomorphy rating ± variance has been 4.8 ± 6.3 (unit-less) in the 4 male subjects and 2.2 ± 2.3 (unit-less) in the 13 female subjects.

3.3. Differences of Means Pairs Significance Levels

No significant difference has been found using the Student's 't' statistic and the related degrees of freedom, in the aim of discovering a possible influence of sports practice on pairs of samples here concerned variables of interest (height, weight, BMI, ectomorphy rating). However, Table 1 and Table 2 show that in most of the cases of the four-academic year period, sports practice (c), compared to non-sports practice (b), seems to cause an increase of height, weight, BMI but a decrease of ectomorphy rating values. Nonetheless, for the academic year mainly concerned by the coming discussion (2016-2017), what pointed out just above recurs in male subjects (Table 1) while occurs the contrary in female subjects (Table 2): a decrease of height, weight, BMI but an increase of ectomorphy rating.

4. Discussion

Four anthropometric variables are concerned in the present study: height, weight, BMI and ectomorphy rating.

As far as we know, ectomorphy rating has not yet been used for health concerns purposes. That is the reason why in the results above and in the discussion below, when the addressed question concerns morbidity and mortality, attention is turned only to height, weight and BMI.

Health concerns may justify the use of a drug. Among the four anthropometric variables, weight is the only one that is used to determine the fraction of the adult drug dose to be administered to a child. Moreover, to date, there still no exist direction for use specially redacted for drug doses to be administered to sportspersons besides drug doses to be administered to non-sportspersons. Hence, when drug administration is concerned, in the results above and in the

discussion below, attention is turned to the weight of all the subjects independently of them being whether sportspersons or not.

Sport practice is likely to cause a change in a practitioner height, weight, BMI and ectomorphy rating. So, in the results above and in the discussion below, when the purpose is sport talent identification, attention is turned to the four anthropometric values shown by the subjects who declared themselves not to be sportspersons, for comparison with the values shown by elite athletes.

4.1. Health Concerns

a) *Morbidity and Mortality*

Height and Weight

The academic year 2016-2017, pulling together the variable values referred to all the students (**Table 1** and **Table 2**), mean height ± variance has been 173.8 ± 38.3 cm in the 56 male subjects and 160.4 ± 49.1 in the 42 female subjects. Pulling together the variables values referred to all the 2016-2017 students (**Table 1** and **Table 2**), mean weight ± variance has been 62.7 ± 69.0 kg in the 51 male subjects and 54.5 ± 86.7 kg in the 39 female subjects. On one hand, mean height vary considerably according to the native country of the adult [4]. On the other hand, once the adult height has been reached, biological impacts on height are limited to some diseases or to some environmental phenomena that accentuate bone loss and osteoporosis [4]. So, we consider at its peak the height of each of the subjects enrolled in the present study as they were aged 18 years and older, the age bracket also taken into account in a recent study by the Non-Communicable Disease Risk Factor Collaboration [12].

Calculating the mean from values falling in a particular interval makes one assume that each of the values is located at the interval midpoint, the latter being obtained computing the mean of the upper and the lower limits of the interval [13]. Normal BMI values lie between 18.5 $kg{\cdot}m^{-2}$ and 24.9 $kg{\cdot}m^{-2}$. In this case, each normal BMI value is assumed to be at the midpoint of the interval, that is to say 21.7 $kg{\cdot}m^{-2}$ [=(18.5 + 24.9) $kg{\cdot}m^{-2} \times 0.5$].

For male subjects, being 173.8 cm the peak height and 21.7 $kg{\cdot}m^{-2}$ the normal BMI value, normal weight is expected to be 65.5 kg instead of 62.7 kg. For female subjects, being 160.4 cm the peak height and 21.7 $kg{\cdot}m^{-2}$ the normal BMI value, normal weight is expected to be 55.8 kg instead of 54.4 kg. To prevent risks related to underweight, the concerned males and females should pay attention not to decrease much their body weight.

Body Mass Index

The discussion below deals first with arithmetic mean values. Each of those means is the value that may be given to each of the measurements value from the concerned population (anthropometry applied to individuals). Then the discussion deals with percentages of subjects who fall into the seven BMI cutoffs set by the World Health Organization (WHO) (anthropometry applied to populations).

BMI mean values of students here concerned (anthropometry applied to individuals)

Stated in $kg \cdot m^{-2}$, a BMI value inferior to 18.5 is that of a subject suffering from underweight; a BMI value lying between 18.5 and 24.9 is normal; a BMI value lying between 25.0 and 29.9 is that of a subject suffering from overweight; a BMI value lying between 30.0 and 34.9 is that of a subject suffering from class I obesity; a BMI value lying between 35.0 and 39.9 is that of a subject suffering from class II obesity; while a BMI value superior or equal to 40.0 is that of a subject suffering from class III obesity [3]. Each of underweight, overweight, and obesity is related to health alterations [4].

Pulling together the BMI values of the 2016-2017 students (Table 1 and Table 2), mean ± variance of 1˚ the subjects who declared themselves not to be sportspersons has been 18.6 ± 9.2 $kg \cdot m^{-2}$ for the 4 male subjects and 22.6 ± 14.9 $kg \cdot m^{-2}$ for the 13 female subjects; 2˚ the subjects who declared themselves to be sportspersons has been 20.9 ± 5.7 $kg \cdot m^{-2}$ for the 45 male subjects and 19.9 ± 2.3 $kg \cdot m^{-2}$ for the 12 female subjects; 3˚ all the subjects concerned with the present study has been 20.7 ± 6.0 $kg \cdot m^{-2}$ for the 51 male subjects and 20.6 ± 20.2 $kg \cdot m^{-2}$ for the 40 female subjects.

The results just above show that non-sportsmen have a BMI mean value of subjects near the lower limit of normal values and suggest that sport practice could improve the value raising it near to the midpoint of BMI normal values class interval, 21.7 $kg \cdot m^{-2}$ [=(18.5 + 24.9) $kg \cdot m^{-2} \times 0.5$].

In non-sportswomen, BMI mean value is slightly above the midpoint 21.7 $kg \cdot m^{-2}$, according to the results just above, could worsen to a value near to the lower limit of normal values. Supervision by sports medicine practitioners is possibly valuable whenever the female subjects concerned by the present study perform sports activities.

Considering all the subjects concerned in the present study, independently of them being whether sportspersons or not, male as well female, BMI mean values lie between the lower limit of normal values and 21.7 $kg \cdot m^{-2}$, the midpoint of BMI normal values class interval, except non-sportswomen mean BMI value (22.6 $kg \cdot m^{-2}$).

Applying international BMI cutoffs would place substantial number of elite athletes into overweight or obese categories [7]. That, according to the results just above, do not apply to 2016-2017 DRC residents sportspersons concerned by the present study.

It has been noticed that [4], 1˚ according to a 1990 report, considerable increases of annual days of disease and days spent in bed by Rwandan females who showed a BMI lower than 18.6; as well as 2˚ from a 1993 study, increasing percentages of male Bangladeshi unable to work, owing to disease, with decreasing BMI [4].

Body fat percentage may be estimated from BMI but there is a relatively large standard error in the prediction [3]. Assuming the error, it can be noticed de-

creasing body fat percentages with decreasing BMI, both in males and females; 20 to 39 years old, 40 to 59 years old, 60 to 79 years old; African-American and White adults [3].

In case of underweight, fat-free tissue (protein-rich) loss conditions survival [4]. Fat-free tissue loss is considerable in case of fasting or in case of infection, and decreases with increasing fat tissue abundance.

Now, in DRC (formerly called Zaire), there are presently permanent (AIDS, tuberculosis, etc) and recurrent (Ebola fever, etc.) communicable diseases as well as malnutrition. The subjects enrolled in the present study reside in DRC and, according to the results above, have shown BMI mean values near to the lower limit of normal values. Actions must be hence carried out to modify the weight mean values and thus BMI mean values so as 1˚ to minimize the impact of exacerbated fat-free tissue loss communicable disease-induced or malnutrition-induced; and 2˚ to increase the chance of survival from infection or malnutrition in DRC, assuming that the population of our study is representative of DRC residents population.

Percentages of subjects who fall into the seven BMI cutoffs set by the WHO

Table 4 shows that the academic year 2016-2017, in male students aged 18 years and older, in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty, 1˚ BMI normal values have been shown by a˚ 100.0% of male who did not pronounce themselves about their participation in sports activities; b˚ 75.0% of males who declared themselves not to be sportspersons; c˚ 77.8% of males who declared themselves to be sportspersons; and d˚ 78.4% of all male subjects observed, whether having pronounced themselves or not about their participation in sports activities; 2˚ BMI underweight values have been shown by a˚ 25.0% of males who declared themselves not to be sportspersons; b˚ 15.6% of males who declared themselves to be sportspersons; and c˚ 15.7% of all male subjects observed, whether having pronounced themselves or not about their participation in sports activities; 3˚ BMI overweight values have been shown by a˚ 6.7% of males who declared themselves to be sportspersons; and b˚ 5.9% of all male subjects observed, whether having pronounced themselves or not about their participation in sports activities.

Table 5 shows that the academic year 2016-2017, in female students aged 18 years and older, in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty, 1˚ BMI normal values have been shown by a˚ 78.6% of females who did not pronounce themselves about their participation in sports activities; b˚ 61.5% of females who declared themselves not to be sportspersons; c˚ 91.7% of females who declared themselves to be sportspersons; and d˚ 76.9% of all female subjects observed, whether having pronounced themselves or not about their participation in sports activities; 2˚ BMI underweight values have been shown by a˚ 14.3% of females who did not pronounce themselves about their participation in sports activities; b˚ 15.4% of females who declared themselves not to be sportspersons; c˚ 8.3% of females who declared themselves to be

sportspersons; and d° 12.8% of all female subjects observed, whether having pronounced themselves or not about their participation in sports activities; 3° BMI overweight values have been shown by a° 7.1% of females who did not pronounce themselves about their participation in sports activities; b° 15.4% of females who declared themselves not to be sportspersons; and c° 7.7% of all female subjects observed, whether having pronounced themselves or not about their participation in sports activities; 4° BMI class I obesity values have been shown by a° 7.7% of females who declared themselves not to be sportspersons; and b° 2.6% of all female subjects observed, whether they have pronounced themselves or not about their participation in sports activities.

Table 6 shows that the academic year 2016-2017, in male and female students pulled together, aged 18 years and older, in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty, 1° BMI normal values have been

Table 4. Percentages, in various WHO BMI cutoffs, of male students aged 18 years and older in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty.

Academic Year	Percentage of BMI below 18.5 (Underweight)	Percentage of BMI between 18.5 and 24.9 (Normal)	Percentage of BMI between 25.0 and 29.9 (Overweight)	Percentage of BMI between 30.0 and 34.9 (Class I obesity)
2013-2014				
a				
b	0.063	0.875	-	0.063
c	0.083	0.792	0.125	-
d	0.075	0.825	0.075	0.025
2014-2015				
a	0.083	0.875	-	0.042
b	-	1.000	-	-
c	0.222	0.778	-	-
d	0.140	0.842	-	0.018
2015-2016				
a	-	1.000	-	-
b	0.091	0.909	-	-
c	0.182	0.773	0.045	-
d	0.125	0.854	0.021	-
2016-2017				
a	-	1.000	-	-
b	0.250	0.750	-	-
c	0.156	0.778	0.067	-
d	0.157	0.784	0.059	-

a relates to the students who failed to provide the information whether they were practicing at least one sport or not; b relates to the students who declared themselves not to be sportspersons; c relates to the students who declared themselves to be practitioners of at least one sport; d relates to male students, independently of whether they have pronounced themselves about their participation in sports activities or not.

Table 5. Percentages, in various WHO BMI cutoffs, of female students aged 18 years and older in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty.

Academic Year	Percentage of BMI below 18.5 (Underweight)	Percentage of BMI between 18.5 and 24.9 (Normal)	Percentage of BMI between 25.0 and 29.9 (Overweight)	Percentage of BMI between 30.0 and 34.9 (Class I obesity)
2013-2014				
a				
b	0.118	0.647	0.176	0.059
c	-	1.000	-	-
d	0.100	0.700	0.150	0.050
2014-2015				
a	0.111	0.889	-	-
b	0.364	0.455	0.182	-
c	-	0.900	0.100	-
d	0.167	0.733	0.100	-
2015-2016				
a	-	0.778	0.222	-
b	0.313	0.563	0.063	0.063
c	-	1.000	-	-
d	0.167	0.700	0.100	0.033
2016-2017				
a	0.143	0.786	0.071	-
b	0.154	0.615	0.154	0.077
c	0.083	0.917	-	-
d	0.128	0.769	0.077	0.026

a relates to the students who failed to provide the information whether they were practicing at least one sport or not; b relates to the students who declared themselves not to be sportspersons; c relates to the students who declared themselves to be practitioners of at least one sport; d relates to female students, independently of whether they have pronounced themselves about their participation in sports activities or not.

Table 6. Percentages, in various WHO BMI cutoffs, of male and female students pulled together, aged 18 years and older in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty.

Academic Year	Percentage of BMI below 18.5 (Underweight)	Percentage of BMI between 18.5 and 24.9 (Normal)	Percentage of BMI between 25.0 and 29.9 (Overweight)	Percentage of BMI between 30.0 and 34.9 (Class I obesity)
2013-2014				
e	0.083	0.783	0.100	0.033
2014-2015				
e	0.149	0.805	0.034	0.011
2015-2016				
e	0.141	0.795	0.051	0.013
2016-2017				
e	0.144	0.778	0.067	0.011

e relates to all the subjects, males and females, concerned by an academic year.

shown by 77.8% of students; 2˚ BMI underweight values have been shown by 14.4% of students; 3˚ BMI overweight values have been shown by 6.7% of students; and 4˚ BMI class I obesity values have been shown by 1.1% of students.

An adult population is healthy when one finds in it a low proportion of individuals suffering from underweight (BMI inferior to 18.5); but when in the population, the percentage of individuals showing underweight BMI values lies between 5.0% and 9.0%, between 10.0% and 19.0%, between 20.0% and 39.0%, and 40.0% and more; the population situation requires observation, is bad, is serious and very serious, respectively [4].

The proportions of adults of adults (18 years and older) suffering from underweight and concerned by the present study (**Table 4** and **Table 5**, 2016-2017) evidence thus a health situation that, 1˚ in males, a˚ is serious (25.0%) in subjects who declared not to be sportspersons; b˚ is bad (15.6%) in subjects who declared to be sportspersons; and c˚ is bad (15.7%) in all the male subjects, whether they have pronounced themselves or not about their participation in sports activities; 2˚ in females, a˚ is bad (14.3%) in subjects who did not pronounce themselves about their participation in sports activities; b˚ is bad (15.4%) in subjects who declared themselves not to be sportspersons; c˚ requires observation (8.3%) in subjects who declared themselves to be sportspersons; and d˚ is bad (12.8%) in all the female subjects, whether they have pronounced themselves or not about their participation in sports activities; 3˚ in males and females pulled together, is bad (14.4%).

Nonetheless, it is worth pointing out that participation in sports activities by males and females (**Table 4** and **Table 5**, 2016-2017, "b" and "c"), possibly improves by decreasing the percentages of underweight BMI values as well as it improves by increasing the percentages of normal BMI values.

Formerly, a study dealt with on University of Kinshasa students (20 years and older) the academic year 1996-1997 [14] has evidenced proportions of subjects with underweight BMI values that reveal a serious health situation (23.40%) in male students and a health situation that requires observation (7.14%) in female students. The study was aimed to bring to light possible nutritional deficiencies that could lead to a malnutrition state. However, the study evidenced sufficient nutritional supplies that consequently did not explain both aforementioned situations. Kodondi *et al.* [14] have thought that those regrettable situations originate from causes other than malnutrition, notably infections, undernourishment during childhood.

Studies have pointed out a mortality increase in low BMI values adults of industrialized societies as well as male adults of BMI values lower than 18.5 [4]. In a given population, an excessive proportion of individuals suffering from underweight could reflect the presence of alimentary insecurity or catabolic consequences of widespread diseases such as acquired immune deficiency (AIDS) and tuberculosis [4]. That may possibly be the case in 1996-1997 [14] and today, as said in the present study.

b) *Pharmacovigilance*

Administering a drug to children, one has to administer only a fraction of the amount that must be administered to the adult. Comparing to dosages based on the age of the child, the dosages based on the weight of the child give the most exact results [2].

Clark's rule [2] is one of the rules used to calculate dosages for children and is formulated as such [Equation (7)]:

$$\text{Child's dose} = \frac{\text{Adult's dose} \times \text{Child's weight expressed in pounds}}{150} \tag{7}$$

Historically, the mass of an average man has been assumed to be 70 kg by physiologists [15]. One hundred and fifty pounds being about 70 kg may explain why University of Kinshasa Medicine Faculty students have been taught in 1977 (we were student) Clark's rule as such [Equation (8)]:

$$\text{Child's dose} = \frac{\text{Adult's dose} \times \text{Child's weight expressed in kilograms}}{70} \tag{8}$$

Doses necessary to produce a given effect while dealing with experimentation being a function of body weight allows the use of the following rule [Equation (9)] [1]:

$$\text{Child's dose} = \frac{\text{Adult's dose} \times \text{Child's weight expressed in kilograms}}{75} \tag{9}$$

Pierre [16] proposes the following rule when one deals with administration of drugs to children [Equation (10)]:

$$\text{Child's dose} = \frac{\text{Adult's dose} \times \text{Child's weight expressed in kilograms}}{50} \tag{10}$$

As while dealing with experimentation dose always relate to body weight kilograms [1], adult weight is assumed to be 75 kg, 70 kg or 50 kg, according to Schmitt's rule [Equation (9)], Clark's rule [Equation (8)] or Pierre's rule [Equation (10)], respectively. When the adult weight is assumed to be 75 kg, 70 kg or 50 kg, each kg of the child body mass must be administered 1/75, 1/70 or 1/50 of adult dose.

Three possibilities may be considered after drug experimentation: 1˚ both adult and child doses have been recommended by the drug direction for use; 2˚ only adult dose has been recommended in the form of a drug amount per body kg; and 3˚ only adult dose has been recommended in the form of a fixed amount of drug, 100 mg for instance. In the third possibility, child dose must be calculated using a rule such those expressed by Equation (9), Equation (8) or Equation (10).

Assuming on one hand that the adult recommended dose results from experimentation on physiologists adult male subjects of 70 kg mean weight, and on the other hand that has been recommended only the adult dose of 100 mg; three possibilities may occur: 1˚ in a geographical area where the mean adult weighs really 70 kg, each body kg is supposed to receive about 1.43 mg/kg (≈100

mg/70kg); 2˚ in a geographical area where the mean adult weighs 75 kg, each body kg is supposed to receive about 1.33 mg/kg (≈ 100 mg/75kg), with the risk of under-dosing and the consequent decrease of drug efficiency, if administering the drug, one is unaware of the fact that the fixed adult dose results from experimentation on 70 kg mean weight adults; but 3˚ in a geographical area where the mean adult weighs 50 kg, each body kg is supposed to receive 2 mg/kg (=100 mg/50kg), with risk of overdosing and the subsequent decrease of harmlessness, if administering the drug, one is unaware of the fact that the fixed adult dose results from experimentation on 70 kg mean weight adults.

DRC adult mean body weight value is now inferior to 70 kg (Table 1 and Table 2), the body weight assumed to be that of the average male adult [15]. Furthermore, adult mean body weight value varies from one geographical area to another, while DRC supply of many drugs relies on importation from abroad. DRC is hence worth looking for the mean weight of the subjects enrolled in the experimentation that led to the adult recommended dose of each imported drug so as, if need be, to adapt it for DRC adults and for DRC children, especially when is required the use of Equation (9), Equation (8) or Equation (10).

4.2. Sport Talent Identification

a) *Talent detection and athletes selection for competition*

It has been noted that it generally takes many years for a high level athlete to achieve his best performance [17]. Similarly, modification of current anthropometric values into ideal anthropometric values may require many years.

Hence, success could rapidly be met practicing sports for which current anthropometric values of the practitioner are close to the ideal values (values shown by most of the best practitioners). That may be taken into account when recruiting sportspersons. Alike, it is careful to expect the best performance only when the concerned competitor current anthropometric values do not lie far from ideal anthropometric values of the concerned sport practitioners.

b) *Anthropometric values discussed below are so, referencing values published by others*

Success in a given sport event is underlay, among other factors, by anthropometric factors, which optimal values are held by the athletes more successful than the others, the latter holding values more and more distant from the optimal ones, as the success decrease [9] [18]. It is worth signaling here that not any variable (anthropometric, physiological, etc.) may by itself be responsible of the talent in a given sport. A variable may only contribute to the observed talent. However, contribution of the concerned variable is better when the latter shows a value than when it shows other values.

A recent study [8] has suggested that boxing could overtax the practitioner the least at the ectomorphy rating of 2.5. The study showed that 2.5 has been the computed mean value of ectomorphy ratings held by 98 of the 100 World top male professional boxers, BoxRec.com ranked, and retired in the period of time

lasting from the beginning of professional boxing practice to March 26th, 2013; and that 2.5 has also been the ectomorphy rating held by most of the 98 professional boxers. Two point four is the mean value of ectomorphy ratings from Spain National Centers of Sports Medicine ["Centros Nacionales de Medicina Deportiva"] [10]; while 2.5 has been reported as ectomorphy ratings mean value of boxers in Korean national-level players [9]. Those ectomorphy ratings mean values, reported from calculations made in different geographical areas and at different levels of sporting competition, constitute a support to the suggestion that at the rating of 2.5, boxing may be the least overtaxing for the practitioner.

As the tendency in sport in general has been toward more homogeneous physiques within sports (and within positions and events in any given sport) and toward more heterogeneous physiques between sports [6], variables mean values of subjects enrolled in the present study have been compared to ideal mean values published by Olds and Tomkinson [6], speaking of height and weight; compared to ideal mean values published López-Silvarrey Varela and Calderón Montero [10], speaking of ectomorphy ratings; and compared to ideal mean values obtained computing from Olds and Tomkinson ideal height and weight mean values, speaking of BMI.

c) *Sporting implications of the anthropometric values shown by the subjects enrolled in the present study*

On one hand, weight is better predictor of capacity for work than height [4] and on the other hand, there exist predictors that combine influence on capacity work of both height and weight, for instance BMI and ectomorphy rating. The latter two are thus taken into account in the following discussion. But in the case that sports coaches lack measurement instruments either for only height or for only weight, conclusions drawn for each of both anthropometric variables may possibly be valuable. Discussion is hence held below taking into account the predictive value, successively, of ectomorphy rating, BMI, weight and height.

In 2016-2017, when sports practice has not yet influenced ectomorphy rating, BMI, weight and height, mean values lead one to expect training of recently recruited sportspersons be less and less successful when sports selected for practice are for instance, in male subjects, volleyball > basketball or cycling > taekwondo > boxing > rugby. As shown below, that is true for ectomorphy rating and BMI, predictors that combine influence of both height and weight. That is almost the same for weight, better predictor of capacity for work than height [4]. That is less true for height: selections of sports results which are similar to the results taking into account ectomorphy rating or BMI are volleyball > rugby and taekwondo > rugby. In corresponding female subjects, the unique sport selection result that is alike to the results taking into account ectomorphy rating or BMI is volleyball > basketball. Follow expectations from training of recently recruited sportspersons when sports are selected as showed just below.

Ectomorphy rating

In 2016-2017, when sports practice has not yet taken place and thus has not

yet influenced ectomorphy ratings, mean values are 4.8 in men and 2.2 in women, respectively (Table 1 and Table 2). One may thus expect training of recently recruited sportspersons be less and less successful when sports (ideal ectomorphy ratings values) selected for practice are, for instance, 1˚ for men, volleyball (3.7) > basketball (3.4) > cycling (3.3) > taekwondo (2.7) > handball (2.5) > boxing (2.4) > football (2.1) > weightlifting [less than 70 kg body weight] (1.8) > rugby (1.3) > judo [more than 85 kg body weight] (1.1) > weightlifting [more than 70 kg body weight] (0.9); and 2˚ for women, weightlifting [less than 70 kg body weight] (2.5) > handball (2.5) > cycling (3.2) > volleyball (3.3) > basketball (3.6).

BMI

In 2016-2017, when sports practice has not yet taken place and hence has not yet influenced BMI values, mean values are 16.8 $kg{\cdot}m^{-2}$ in men and 18.8 $kg{\cdot}m^{-2}$ in women, respectively (Table 1 and Table 2). One may thus expect training of recently recruited sportspersons be less and less successful when sports (ideal $kg{\cdot}m^{-2}$ BMI values) selected for practice are, for instance, 1˚ for men, marathon (20.7 $kg{\cdot}m^{-2}$) > running [distance] (20.8 $kg{\cdot}m^{-2}$) > cycling [road] (21.6 $kg{\cdot}m^{-2}$) > volleyball (22.1 $kg{\cdot}m^{-2}$) > taekwondo (22.6 $kg{\cdot}m^{-2}$) > swimming (23.0 $kg{\cdot}m^{-2}$) > running [sprint] (23.6 $kg{\cdot}m^{-2}$) > basketball (24.2 $kg{\cdot}m^{-2}$) > rugby [backs] (26.1 $kg{\cdot}m^{-2}$) > boxing [heavyweight] (28.5 $kg{\cdot}m^{-2}$) > rugby [forwards] (29.4 $kg{\cdot}m^{-2}$); and for women, basketball (22.1 $kg{\cdot}m^{-2}$) > volleyball (21.5 $kg{\cdot}m^{-2}$) > tennis (20.7 $kg{\cdot}m^{-2}$) > or running [distance] (19.1 $kg{\cdot}m^{-2}$) > marathon (18.7 $kg{\cdot}m^{-2}$).

Weight

In 2016-2017, when sports practice has not yet influenced weight, mean values are 55.8 kg in men and 59.4 kg in women, respectively (Table 1 and Table 2). Training of recently recruited sportspersons may thus be expected to be less and less successful when sports (ideal kg weight values) selected for practice are, for instance, 1˚ for men, marathon (61.9 kg) > running [distance] (63.2 kg) > cycling [road] (68.5 kg) > taekwondo (69.4 kg) > running [sprint] (76.1 kg) > volleyball (77.0 kg) > rugby [backs] (84.2 kg) > basketball (97.0 kg) > boxing [heavyweight] (102.6 kg) > rugby [forwards] (103.6 kg); and 2˚ for women, marathon (50.6 kg) > running [distance] (50.3 kg) or is tennis (62.6 kg) > volleyball (68.2 kg) > basketball (69.0 kg).

Height

In 2016-2017, when sports practice has not yet taken place and thus has not yet influenced height, mean height values are 173.4 cm in men and 162.2 cm in women (Table 1 and Table 2); what leads one to expect training of recently recruited sportspersons be less and less successful when sports (ideal cm height values) selected for practice are, for instance, 1˚ for men, running [distance] (174.5 cm) > taekwondo (175.3 cm) > rugby [backs] (176.9 cm) > cycling [road] (178.1 cm) > running [sprint] (179.6 cm) > volleyball (186.5 cm) > rugby [forwards] (187.6 cm) > boxing [heavyweight] (189.9 cm), or is marathon (172.9 cm); and 2˚ for women, running [distance] (162.4 cm) > marathon (164.3 cm) > tennis (173.9 cm) > basketball (176.8 cm) > volleyball (178.2 cm).

5. Conclusions

5.1. Mean Values

The study has yielded what follows from students aged 18 years and older in their second year at the University of Kinshasa Pharmaceutical Sciences Faculty, the academic year 2016-2017.

a) In male students

1˚ mean height ± variance has been a˚ (169.5 ± 4.2) cm in the 3 students who failed to provide the information whether they were practicing at least one sport or not; b˚ (173.4 ± 59.1) cm in the 6 students who declared themselves not to be sportspersons; c˚ (174.2 ± 37.9) cm in the 47 students who declared themselves to be practitioners of at least one sport; d˚ (173.8 ± 38.3) cm in all the 56 students, independently of whether they have pronounced themselves about their participation in sports activities or not.

2˚ mean weight ± variance has been a˚ (56.5 ± 29.6) kg in the 2 students who failed to provide the information whether they were practicing at least one sport or not; b˚ (55.8 ± 31.2) kg in the 4 students who declared themselves not to be sportspersons; c˚ (63.6 ± 68.7) kg in the 45 students who declared themselves to be practitioners of at least one sport; d˚ (62.7 ± 69.0) kg in all the 51 students, independently of whether they have pronounced themselves about their participation in sports activities or not.

3˚ mean BMI ± variance has been a˚ (19.7 ± 1.6) $kg{\cdot}m^{-2}$ in the 2 students who failed to provide the information whether they were practicing at least one sport or not; b˚ (18.6 ± 9.2) $kg{\cdot}m^{-2}$ in the 4 students who declared themselves not to be sportspersons; c˚ (20.9 ± 5.7) $kg{\cdot}m^{-2}$ in the 45 students who declared themselves to be practitioners of at least one sport; d˚ (20.7 ± 6.0) $kg{\cdot}m^{-2}$ in all the 51 students, independently of whether they have pronounced themselves about their participation in sports activities or not.

4˚ mean ectomorphy rating ± variance has been a˚ 3.7 ± 0.3 in the 2 students who failed to provide the information whether they were practicing at least one sport or not; b˚ 4.8 ± 6.3 in the 4 students who declared themselves not to be sportspersons; c˚ 3.5 ± 1.6 in the 45 students who declared themselves to be practitioners of at least one sport; d˚ 3.6 ± 2.0 in all the 51 students, independently of whether they have pronounced themselves about their participation in sports activities or not.

b) In female students

1˚ mean height ± variance has been a˚ (157.7 ± 47.1) cm in the 15 students who failed to provide the information whether they were practicing at least one sport or not; b˚ (162.2 ± 23.9) cm in the 14 students who declared themselves not to be sportspersons; c˚ (161.5 ± 72.8) cm in the 13 students who declared themselves to be practitioners of at least one sport; d˚ (160.4 ± 49.1) cm in all the 42 students, independently of whether they have pronounced themselves about their participation in sports activities or not.

2˚ mean weight ± variance has been a˚ (51.8 ± 59.6) kg in the 14 students who

failed to provide the information whether they were practicing at least one sport or not; b˚ (59.4 ± 123.3) kg in the 13 students who declared themselves not to be sportspersons; c˚ (52.4 ± 51.5) kg in the 12 students who declared themselves to be practitioners of at least one sport; d˚ (54.5 ± 86.7) kg in all the 39 students, independently of whether they have pronounced themselves about their participation in sports activities or not.

3˚ mean BMI ± variance has been a˚ (19.4 ± 36.1) $kg{\cdot}m^{-2}$ in the 15 students who failed to provide the information whether they were practicing at least one sport or not; b˚ (22.6 ± 14.9) $kg{\cdot}m^{-2}$ in the 13 students who declared themselves not to be sportspersons; c˚ (19.9 ± 2.3) $kg{\cdot}m^{-2}$ in the 12 students who declared themselves to be practitioners of at least one sport; d˚ (20.6 ± 20.2) $kg{\cdot}m^{-2}$ in all the 40 students, independently of whether they have pronounced themselves about their participation in sports activities or not.

4˚ mean ectomorphy rating ± variance has been a˚ 2.5 ± 2.3 in the 14 students who failed to provide the information whether they were practicing at least one sport or not; b˚ 2.2 ± 2.3 in the 13 students who declared themselves not to be sportspersons; c˚ 3.2 ± 0.9 in the 12 students who declared themselves to be practitioners of at least one sport; d˚ 2.6 ± 1.9 in all the 39 students, independently of whether they have pronounced themselves about their participation in sports activities or not.

c) In male and female students pulled together

1˚ mean height ± variance has been (168.1 ± 87.4) cm in all the 98 measured subjects; 2˚ mean weight ± variance has been (59.1 ± 92.3) kg in all the 90 measured subjects; 3˚ mean BMI ± variance has been (20.6 ± 12.1) $kg{\cdot}m^{-2}$ in all the 91 measured subjects; and 4˚ ectomorphy rating ± variance has been 3.2 ± 2.2 in all the 90 measured subjects.

5.2. Health Situation Concern

The proportions of adults of adults (18 years and older) suffering from underweight and concerned by the present study evidence thus a health situation that, 1˚ in males, a˚ is serious (25.0%) in subjects who declared not to be sportspersons; b˚ is bad (15.6%) in subjects who declared to be sportspersons; and c˚ is bad (15.7%) in all the male subjects, whether they have pronounced themselves or not about their participation in sports activities; 2˚ in females, a˚ is bad (14.3%) in subjects who did not pronounce themselves about their participation in sports activities; b˚ is bad (15.4%) in subjects who declared themselves not to be sportspersons; c˚ requires observation (8.3%) in subjects who declared themselves to be sportspersons; and d˚ is bad (12.8%) in all the female subjects, whether they have pronounced themselves or not about their participation in sports activities; 3˚ in all males and all females pulled together, is bad (14.4%). However, sports practice could improve the situation at the population level, even if at the individual level, BMI values seem to improve in males but to worsen in females.

5.3. Pharmacovigilance Concern

Seventy kilograms of the physiologists adult male [15] are heavier than the mean weight shown by the subjects enrolled in the present study, males alone (62.7 kg), females alone (54.5 kg), or males and females pulled together (59.1 kg). As while dealing with pharmacological experimentation, dose relate to body weight kilograms [1], DRC is worth looking for the mean weight of the subjects enrolled in the experimentation that led to the adult recommended dose of each imported drug so as, if need be, to adapt the dose to DRC residents.

5.4. Talented Sportspersons Identification

Because 1˚ in general, the tendency has been toward more similar physiques within sports but toward very different physiques between sports [6]; 2˚ modification of current anthropometric values into ideal anthropometric values may require many years; referencing values published by others has helped giving examples of recruiting sportspersons so as to expect training be rapidly successful and to expect sports practitioners be at their best performance during competitions.

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