

# ANTHROPOMETRIC ASPECT (STATO-WEIGHT) OF GIRLS SCHOOLED AT FOKONTANY VOHIBINANY BRICKAVILLE MADAGASCAR (6 to 12 years)

Boromé RAMAROMILANTO<sup>1\*</sup>, Lala Harivelo RAVAOMANARIVO<sup>2</sup>, Haingoson ANDRIAMIALISON<sup>3</sup>,

<sup>1</sup> *Laboratory of Physical Anthropology - Faculty of Sciences of the University of Antananarivo Madagascar,*

<sup>2</sup> *Doctoral School of Life Sciences and Environment Faculty of Sciences of the University of Antananarivo, Madagascar*

<sup>3</sup> *Laboratory of Nutritional Anthropology - Faculty of Sciences of University of Antananarivo, Madagascar*

## ABSTRACT

*The majority place in society is occupied by children. They will grow up to become the future leaders and actors in the nation. 219 girls aged 6 to 12 years from public schools (primary and secondary) in Vohibinany Brickaville Madagascar were measured staturally and weight, and investigated about their identity, age, parents' names and professions as well as their drug dependency. The evolution of the children's growth curve and the comparisons made with the WHO data allow us to say that these girls are underweight and statural and are emaciated. This malnutrition, so-called protein-energy, or more precisely under nutrition, alternates between subnormal and pathological*

**Keywords:** *Child, height, weight; body mass index, z-score, malnutrition, Vohibinany, Brickaville, Madagascar*

## 1. INTRODUCTION

The anthropometric growth of children corresponds to the increase in the number and volume of cells, and is expressed by an increase in overall body dimensions: weight and height [3]. The biometric growth of the child reflects biological and physical development [7] and is manifested by changes in dimensions and proportions of the body [17], then by changes in body morphology reinforcing the concept of organic and functional maturation [1], [12].

This growth, this development and this maturation are fundamental aspects of the same vital phenomenon which is that of cell division and multiplication [3].

In this study, in order to describe the anthropometric aspect of the girls of Vohibinany, we present some characteristics of the growth of female sex of school age of this District to quote the staturo-ponderal development and their index necessary in order to analyze the profile girls, their evolution and their speed of growth.

Thus, these average values will be the subject of comparison with other anthropometric referential data [6], [11]. in order to classify and categorize this anthropometric aspect.

## 2. SUBJECTS AND METHOD

### 2.1. Study site

The District of Brickaville formerly called Ampasimanolotra, is one of the administrative divisions or sub-prefectures constituting the Atsinanana Region, in the East of the Island, of the Province of Toamasina, MADAGASCAR, with coordinates 18° 39' 39" South, 48° 51' 56" East. Our study is focused in Fokontany Vohibinany, center of the Municipality of Brickaville Recently calculated by road called National Route number 2 or RN2, it is located 102 kilometers south of the capital of this Atsinanana Region and 219 km from the National Capital or Tananarivo. (Maps 1,2)



Map 1 : Site of study



Map 2: Localisation of Vohibinany (Source Google Map data 2023)

## 2.2. Human material

Before investigating each subject, we asked for their current state of health, which we verified by taking their temperature. Only healthy or apparently "healthy" subjects are considered. Students who suffered from a chronic pathology that could affect their growth were excluded from this study. Our field activities took place during the months of April, May, and June of the year 2022

Investigations, examinations and measurements were carried out on school-aged girls in the Brickaville area. We have retained in our analysis 219 subjects, from Public Primary and Secondary School Fokontany Vohibinany at the Center of the Municipality of Brickaville, with a representativeness of approximately 30 individuals for each age group of unitary amplitude equal to one year. to be able to study the phenomenon of growth and development. The observation age groups range from 6 to 12 years old. When the necessary number is reached for the first age group, we will start the second and so on.

The dates of birth of our subjects show that the children examined and measured are from the period of 2010 to 2016.

## 2.3. Methodology

The subjects are chosen at random without distinction of ethnic origin, castes, family ties and the social level of the parents. Each subject has a pre-established personal file containing the essential information to be completed mentioned above:

- Identity of the subject: names, age, gender
- Structure of each family: number of brothers, sisters and parents
- Identity of parents and their professional activities of survey
- Toxic behavior of parents (alcohol and tobacco)
- We admit a certain difficulty in questioning the subject, we count on the other hand on the quality, the capacity and the strategy of approach adopted by the investigator. In this way, we can ensure the reliability of the data collected.-
- Measurement

Generally, this study encompasses the Auxology or metric science of growth and human biometrics.

We chose the measurable parameters "body height and mass" for the supreme reason that these body dimensions are the most common for tracking growth as a function of age.

- Height or stature is a longitudinal dimension allowing the development of bone tissue to be assessed.

We measured the standing height or stature which is a height from the vertex to the ground [17]. On a barefoot subject [11], as military attention [6], arms hanging, heels joints, the gaze plane horizontal, and the back leaning against the vertically fixed anthropological measuring board. The latter is a removable measuring instrument graduated to the nearest millimeter [5]. We lower the slider of the shaved height gauge on the head, in contact with the skull and hold the slider firmly in place. Lower the slider of the measuring board until it contacts the skull and hold it firmly in place. We read and note finally the number of the graduation which is immediately below the cursor.

- The body mass of a person, usually anthropologically called his "weight" which is a parameter characterizing the development of the whole, including the soft parts.

We used an electronic scale, a TRIUMPH brand impedance meter, which is a precision weighing instrument.

Theoretically, the subject must be barefoot and naked or almost or with very light clothing. It must not be in contact with any object [11]. Otherwise, in the impossibility of stripping him, it was suggested that the subject keep his clothes, but it is necessary to estimate the average weight of his clothes which is then subtracted from the body mass of the subject to have the weight real of the subject.

- And to properly judge the state of development of a child, it is important to calculate the body mass index (BMI) which takes into account the age of the child.

These dimensions also define its constitutional state and its growth rate, which are generally controlled by comparison with reference percentages [6]. [8].

## 2.4. Data analysis

As part of our study in the District of Brickaville, we are developing software or a platform called "BOROME-ENQUETE" which aims to:

- Facilitate the capture of survey results
- Have data storage insurance

Extract and use the data entered for statistical and other purposes

### 3. RESULTS AND DISCUSSIONS

The results are in the form of tables and charts, followed by discussions

**Table 1:** Result of weight averages and WHO reference data (2007 WHO Reference Z-scores)

Age groups (years) GIRLS	Effective	Average_weight (Kg)	Difference from average	Weight standard deviation	Weight growth rate	WHO (-2SD)	WHO (-1SD)	WHO Median
[6 à 7[	30	18,0666		4,0982		16	18,3	21,2
[7 à 8[	32	18,6875	0,6209	4,1940	0,0958	17,6	20,3	23,6
[8 à 9[	32	21,2187	2,5312	2,3682	-1,8258	19,6	22,7	26,6
[9 à 10[	30	22,0666	0,8479	4,7953	2,4271	22	25,5	30
[10 à 11[	33	25,9696	3,903	4,2318	-0,5635	22,5	27,5	34
[11 à 12[	32	30,8125	4,8429	6,8622	2,6304	25,6	31,2	37
[12 à 13[	30	34,1333	3,3208	7,5221	0,6599	28,7	35	43,4

Total effective: 219

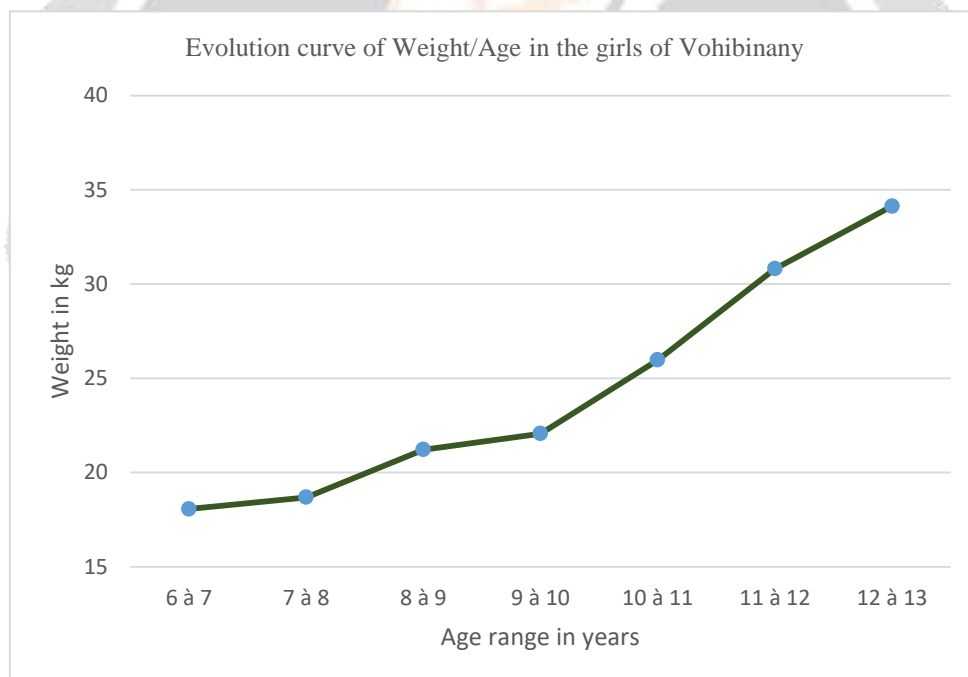
**Table 2:** Result of height averages and WHO reference data (2007 WHO Reference Z-scores)

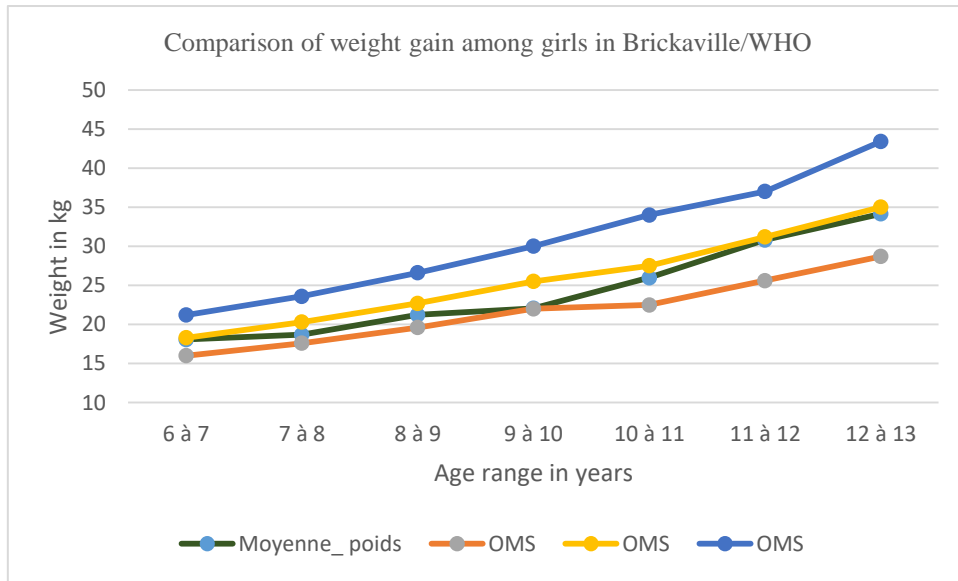
Age groups (years) GIRLS	Effective	Average height (Cm)	Difference from average	Height standard deviation	Height growth rate	OMS (-2SD)	OMS (-1SD)
[6 à 7[	30	112,6666		4,9888		107,4	112,7
[7 à 8[	32	116,3125	3,6459	5,9342	0,9454	112,4	118
[8 à 9[	32	119,6875	3,375	5,5138	-0,4204	117,6	123,5
[9 à 10[	30	126	6,3125	6,1427	0,6289	123	129
[10 à 11[	33	130,3030	4,303	7,9486	1,8059	128,7	135,3
[11 à 12[	32	135,9375	5,6345	7,4201	-0,5285	134,7	141,4
[12 à 13[	30	141,5333	5,5958	8,5974	1,1773	140,2	147,1

Total effective : 219

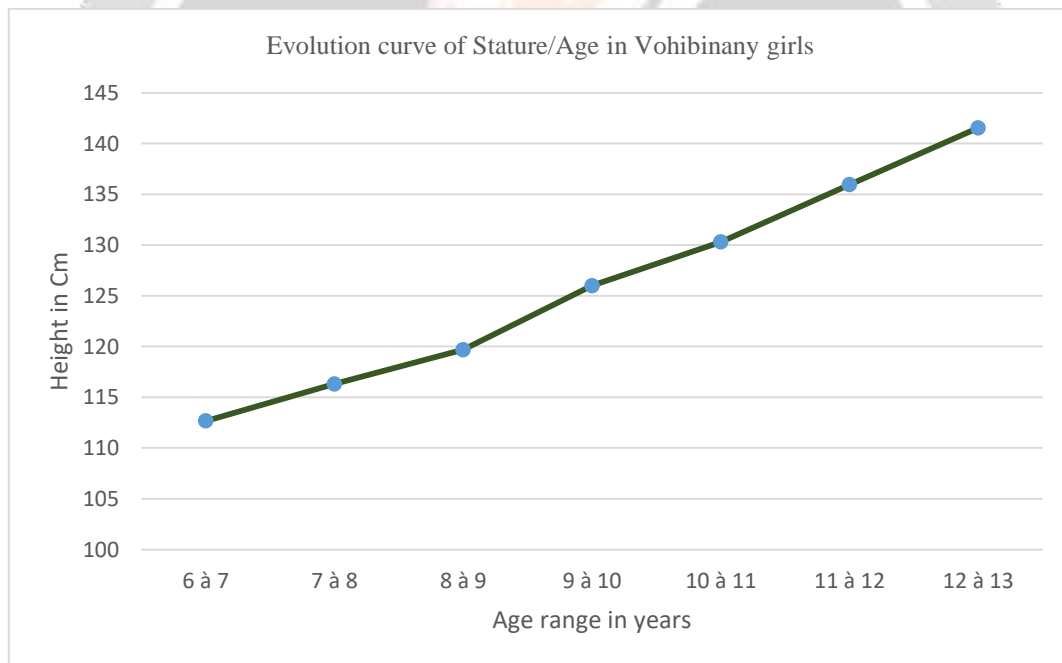
**Table 3:** Result of BMI and WHO reference data (2007 WHO Reference Z-scores)

Age groups (years) GIRLS	BMI kg/m <sup>2</sup>	Difference from BMI	WHO (-2SD)	WHO (-1SD)	WHO (Median)
6 à 7	14,2326		12,7	13,9	15,3
7 à 8	13,8133	-0,4193	12,8	14	15,5
8 à 9	14,8122	0,9989	13	14,2	15,8
9 à 10	13,8993	-0,9129	13,3	14,6	16,3
10 à 11	15,2952	1,3959	13,6	15	16,9
11 à 12	16,6743	1,3791	14,1	15,6	17,5
12 à 13	17,0396	0,3653	14,6	16,2	18,3

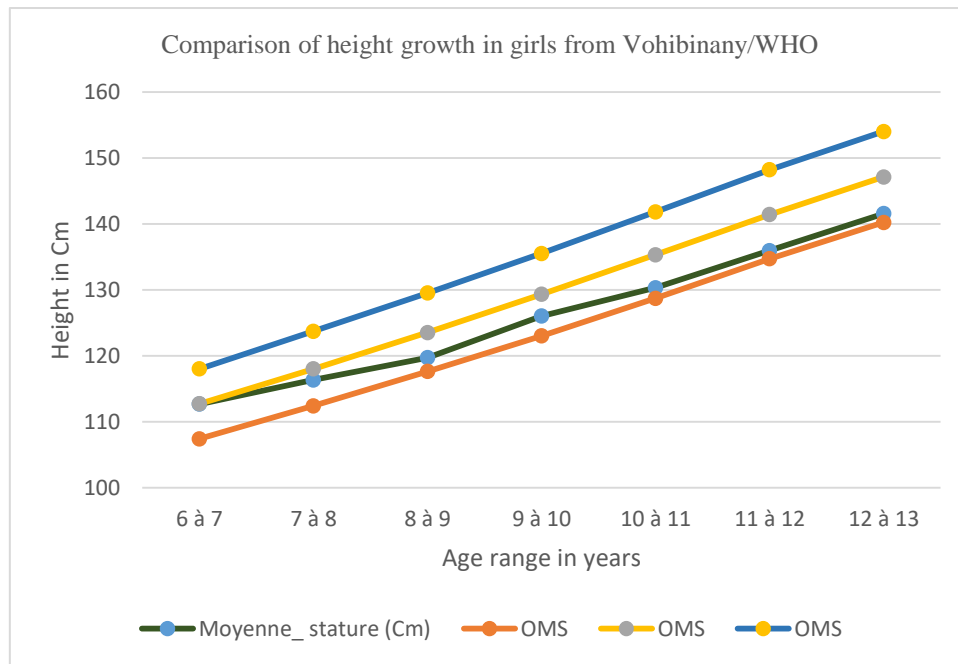
**Chart 1:** Curve of weight growth in relation to age for girls in Vohibinany



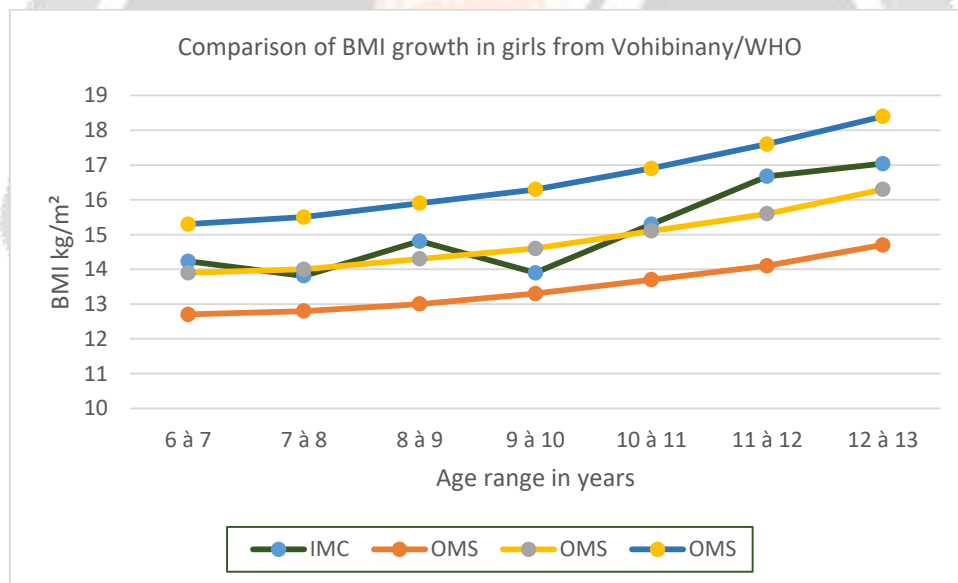
**Chart 2:** Comparison curve of weight growth / WHO in girls from Vohibinany (2007 WHO Reference Z-scores)



**Chart 3:** Growth curve by age for girls in Vohibinany



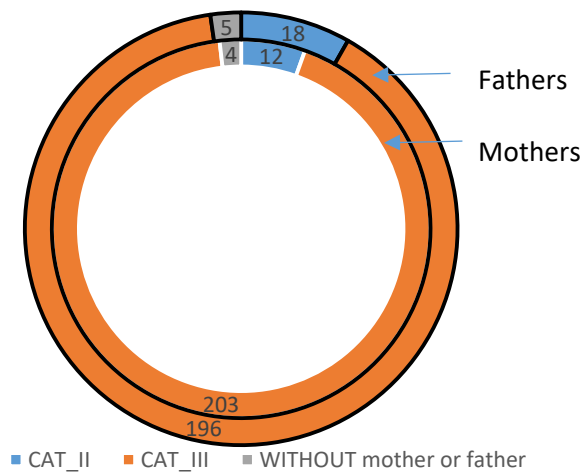
**Chart 4:** Growth curve / WHO by age in girls from Vohibinany (2007 WHO Reference Z-scores)



**Chart 5:** Evolution curve of BMI / WHO by age in girls from Vohibinany (2007 WHO Reference Z-scores)

**Table 5:** Occupational categories

Category_occupation	Mothers		Fathers	
	Effective	Proportion (%)	Effective	Proportion (%)
CAT_II	12	5,47	18	8,21
CAT_III	203	92,69	196	89,49
WITHOUT mother or father	4	1,82	5	2,28



**Chart 6:** Occupational categories

**Tableau 6 :** Repartition of Cat III

Cat III	Effective	Proportion(%)
Small informal sellers	158	39,60
Unemployed	118	29,57
Fruist and vegetables sellers	42	10,53
Farmers	40	10,02
Day laborers and artisans	19	4,76
Fishermen	9	2,76
Drivers and rickshaw pullers shooters	9	2,76

Total = 399

**Tableau 7 :** Repartition of Cat II

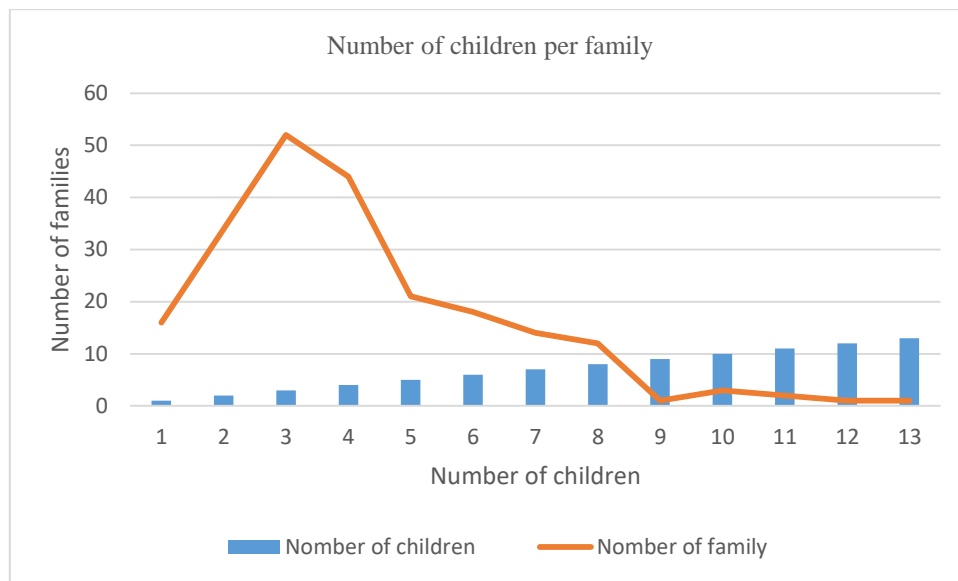
Cat II	Effective	Proportion(%)
Education agents	22	73,33
Health workers	4	13,33
Commercial agents	2	6,66
Church leaders	2	6,66

Total = 30

**Table 8:** Number of children per family

Number of children	1	2	3	4	5	6	7	8	9	10	11	12	13
Number of families	16	34	52	44	21	18	14	12	1	3	2	1	1





**Chart 6:** Chartic representation of the number of children per family

**Table 9:** Parent toxic dependency

Toxic investigation	Mothers		Fathers	
	Effective	Proportion (%)	Effective	Proportion (%)
NONE	209	95	124	56,62
TOBACCO	1	0,45	19	8,67
ALCOHOL	8	3,65	41	18,72
TOBACCO;ALCOHOL	1	0,45	35	15,98

According to the tables and Charts above:

1. The average weights vary according to age between 18.06 kg for 6 year olds and 34.13 kg for 12 year olds. The annual weight gain is between 0.62 kg and 4.84 kg. (Table1).

The weight growth curve is almost straight when the weight gain is very low: case of the transition from 6 years to 7 years; and that of 9 years and 10 years. It obviously increases thereafter, observing a strong recovery with a maximum weight gain in 11 years. It is an acceleration of weight gain. (Chart 1)

In general, we notice an oscillation of the rhythm of weight growth, that is to say an alternation of periods of slowing down and periods of pushing.

For all comparisons with the reference data of the World Health Organization or WHO, the average values of each age group are taken; for example the value of 6 years and 6 months for the age class 6 to 7 years. (Chart 2). The weight growth chart for school aged girls in Vohibinany is in the range of (-2SD) and (-1SD). It corresponds to a subnormal nutritional state. At 6 years old, she is close to (-1SD). It oscillates in sawtooth up to 9 years when it is close to (-2SD). Then it increases returning close to (-1SD), but still remains within the range mentioned above.

2. Average height changes with age groups. It ranges from 112.66 cm for 6 years and 141.53 cm for 12 years. Height gain is between 3.37 cm and 6.31 cm per year. (Tables 1 and 3)

Between 6 and 8 years, the speed of growth is almost equal. From 8 to 9 years old; it doubles hence an accentuated pace. It decreases at 10 years, then increases a little and stabilizes afterwards (Chart 3). This decrease in the height accretion rate expresses a certain apparent slowing down of growth.

This result shows us that, the general pace of statural development was presented by periods of slowness separated by periods of thrust.

Referring to WHO data (Chart 4), the height growth curve is in the range between (-1SD) and (-2SD). More precisely, at 6 years old it is close to (-1SD) then gradually detaches from it at 7 years old and tends towards (-2SD) at 8 years old. It increases a little towards the middle of (-2SD) and (-1SD) at 9 years and drops again towards the (-2SD) curve and becomes very close at 12 years.

From the nutritional point of view, this state has a relationship with the subnormal nutritional state with a pathological tendency.

3. By combining the two parameters weight and height with age, we have the body mass index (BMI). It can be roughly calculated by dividing your body weight, in kilograms, by your height, in meters squared ( $BMI = \text{weight in kg} / \text{height}^2 \text{ in m}$ ). It is a health indicator commonly used and generalized internationally with pre-established scales where any interpretation is made according to the WHO classification.

It is noted that all the indices calculated from the formula announced above are less than 18.5. This means that our subjects on average are underweight. The latter is severe for girls of 6, 7, 8, 9 and 10 years old because they are below 16.5. In other words, our subjects in these age groups are anorexia or malnourished.

This underweight became moderate at 11 years old because the BMI is between 16 and 16.99, that is to say 16.67. She then evolves into a slight underweight because this index increases and reaches the value of 17.04 at 12 years. Consequently, the subjects of these two age groups are thin.

Apart from the hereditary or endogenous influence and other exogenous factors, our discussion and our interpretation are based on socio-economic variables, such as the professional category of the parents, the structure of each family and the toxic dependence.

According to the result obtained on the professional activities of the parents of the 219 girls surveyed and according to the professional categories adopted in [13]. We have the data mentioned in Table 5 and Chart 6. Their majority is found in the category III: 92.69% in mothers and 89.49% in fathers. Their parents are in the subordinate, lower, modest and low class, with a predominance of small informal sellers, the unemployed, fruits and vegetables sellers, farmers, day laborers and artisans, fishermen, drivers and rickshaw pullers shooters (Table 6). They all have low and insufficient incomes.

5.47% of mothers and 8.21% of fathers belong to category II, which is an average category comprising middle-class employees, as intermediate education agents or administrators (in preschool, primary, secondary, high school) and health (paramedics and veterinary workers), professional and commercial agents (meat wholesaler) and church leaders (Table 7). It seems that the economic environment intervenes to explain certain anthropological variations, especially in childhood. The socio-economic level conditions life and is reflected in the state of growth and development of children, in particular, the values of height and weight appear lower in poor environments. This socio-economic level, source of family income, therefore conditions the standard of living and constitutes a factor of differentiation of anthropometric characteristics: physical, psycho-social and mental development of children through nutritional, health and educational powers.

The household size we insist on the number of children per family whose minimum is equal to 1, the maximum is equal to 13, the mode is equal to 3 and the average is equal to 3. The extent of dispersion is equal to 12. We can still see that most of the subjects come from large families (Table 8). This result also allows us to say that there is a fairly strong demographic push or a high proportion of young people, which is an indicator of underdevelopment. This rapid growth, the slow evolution of food production caused by the low rate of farmers and the high rate of unemployed people cause a food deficit marked by undernourishment. All these factors affect the life condition and growth of children.

In addition, the toxic dependence of parents (Table 9) shows us that 45.38% of fathers and 5% of mothers smoke and/or drink alcohol. This toxic dependence has a negative effect on the family budget, the education of the children, the climate or atmosphere at home, the creation of an emotional imbalance and the establishment of dysfunctional communication. It is obvious that toxic parents are not able to respect their child's needs and who

they are. All this leads to personality disorders, the creation of addictions and dependencies and delays presented by the children in language, behavior, growth, psychomotor,...

#### 4. CONCLUSION

A rapid population growth marked here by the size of the household, a high unemployment rate, underemployment, insufficient parental income and a low rate of farmers as well as their yields lead on the one hand to a dissatisfaction of the needs families and on the other hand cause a food deficit or a situation marked by poverty. All this is aggravated by the toxic dependence (tobacco and alcohol) of the parents, and influences the condition of life, health and the growth of the children. Comparing with WHO baseline data, girls attending school in Vohibinany are underweight, understated and emaciated. This protein-energy malnutrition, or undernutrition oscillates alternately between subnormal and pathological.

This insufficiency affects the brain and will subsequently limit the intellectual capacities of children, their productivity and their life expectancy. So in perspective, suggestions to authorities and parents are necessary if we want to improve the growth and physical development of children and fight against malnutrition. First of all, we must think about creating new jobs and generating activities, helping the already existing sectors of activity such as agriculture, livestock, crafts, etc. Moreover, to improve the road infrastructure to facilitate access, trade and sale of agricultural products. In addition, the social, educational, health and nutritional infrastructures. And finally, the quality of service offered, training and knowledge sharing, new technology towards the progress of each household. All in all, it is necessary to take in hand these problems related to the growth and development of children to free them from this vicious circle and have a better future.

#### 5. REFERENCES

1. Aguilar T. 1979 « Enfant et santé ». Le guide pratique Dammarie les Lys France
2. Bahchachi, N., Dahel-Mekhancha, C.C., Rolland-Cachera, M.F., Roelants, M., Hauspie, R., Nezzal, L. 2017. « Courbes de l'indice de masse corporelle d'enfants et adolescents algériens (6–18 ans) ». Archives de Pédiatrie, 24(12), 1205-1213.
3. Bouabida 2020 « Croissance normale des enfants », Département de médecine, Université d'ORAN Algérie
4. Dahel-Mekhancha, C.C., Nezzal, L. 2018. « Intérêt des courbes de croissance nationales pour les enfants et adolescents algériens ». Nutrition & Santé, 7(1), 1–15.
5. Eric Brangier, Gerard Valléry 2021 « Anthropométrie »
6. Freeman, J. V., 1995. « Cross sectional stature and weight reference curves for the UK, 1990 ». Archives of Disease in Childhood, 73(1), 17–24.
7. Masse N.P. et Mande M. M. 1972 « Développement physique de l'enfant » Paris Flammarion
8. OLIVIER G.1960 « Pratique anthropologique » paris VIè édition Vigot Frères, 23 rue de l'Ecole de médecine »
9. OMS, 2007. Growth reference data for 5-19 years. <https://www.who.int/growthref/en/>
10. OMS, 2016. Qu'est-ce que la malnutrition? <https://www.who.int/features/qa/malnutrition/fr/>
11. Ramaromilanto B. 2001 « Croissance et développement physique des enfants de Brickaville » Diplôme d'Etudes Approfondies, Université d'Antananarivo
12. Ranaivoarisoa R.N.M.F, 1984 « Croissance de l'enfant de 10 à 19 ans et maturation pubertaire » thèse de doctorat climatique en médecine, Université d'Antananarivo
13. Rakotonirainy T. et al, 1996 « Les salaires de la honte ». Revue de l'Océan indien Madagascar
14. Sbaibi, R., Aboussaleh, Y. 2011. Étude exploratoire de l'état staturo-pondéral des enfants collégiens dans la commune rurale Sidi El Kamel au Nord-Ouest Marocain. Antropo, 24, 61-66.
15. Sbaibi, R., Aboussaleh, Y., Ateillah, K., Ahami, A. O. T. 2013. Étude longitudinale de l'état staturo-pondéral des collégiens de la commune rurale Sidi El Kamel (Nord-Ouest Marocain). Antropo, 29, 125-131.
16. Thibault, H., Boulard, S., Colle, M. 2009. Croissance normale staturo pondérale. Elsevier Masson SAS.
17. Twisserman F. 1969 Développement biométrique de l'enfant à l'adulte. Presse universitaire de Bruxelles, Paris Maloine Edition