Metabolic diseases (type II diabetes, obesity) and physical activity levels of students

aged 13-18

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ABSTRACT

The aim of this study is to describe the level of physical activity (LPA) and its effect on obesity and type II diabetes in schoolchildren in the regions of the wilaya of Bejaia. A sample of 110 (F/G= 55/55) obese and type II diabetic (O D T II) students, aged 13 to 18 years, studied in two age groups and separately by sex, surveyed by a questionnaire, their (LPA), body mass index (BMI) and their ages of attainment of (DT II) were taken. The results of the questionnaire show that the subjects studied are inactive which coincides with the increase in their BMI. The results of the correlation test show that there is a relationship between (LPA) and (BMI). r = (-0.78) and (-0.96) for boys and girls aged 13 - 15, r = (-0.81) and (-0.92) for boys and girls aged 16 - 18.

The age of onset of (DT II) for our sample varies between 11 and 15 years of age, which means that these students have been involved in diabetes since the early years of obesity. Finally, our study shows that (O D T II) in school students, due to the decrease in their (LPA), is below the recommendations required to maintain health.

Keywords: Obesity; Diabetes type II; BMI; LPA; Metabolic diseases.

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INTRODUCTION

Current epidemiological work emphasises the increasing prevalence of metabolic diseases, obesity and type II diabetes.

Obesity is a rapidly growing disease situation in the world and has been increasing since the 1990s (Lamandé & al, 2011). Obesity as a major public health problem worldwide (Rolland-Cachera & MF, 2004)

Childhood obesity is observed in industrial countries first and also in developing countries. According to the 2006 National Nutrition and Health Study (ENNS), among children aged 3 to 17 years, 14.3% are overweight and 3.5% are obese; childhood obesity is considered to be caused by the interaction between various factors (Conseil Général de l'Essonne, 2011).

While obesity is now considered "a major contributor to the global burden of disease" as stated by the World Health Organization (Weineck, 1997) (Obesity, sedentary lifestyle is a major risk factor for many health problems such as type 2 diabetes, osteoporosis, cardiovascular disease and certain cancers (Comité scientifique de kino-Québec, 2006). The risk of developing type II diabetes is related to body mass index (BMI) (Cook S, 1988-1994)

Physical activity is, to date, a recognised factor in the prevention and even treatment of a large number of pathologies. To be effective, this activity must be practised regularly, at a sufficient level of intensity. It is now recognised that the usual level of physical activity is an important determinant of health status at all ages (Oppert JM & al, 2005). Despite a certain but passive interest in competitive sports activities, educational physical practice remains subordinated to its function of leisure and exaggerated release of tension. This, in a way, relegated it to second place in the concerns of our population (Boutalbi.B & Zouaghi.C, 2017).

Our research leads us to ask the following question: What is the relationship between physical activity level (PAL) and body mass index BMI?

To answer this question we assume :

-Lack of physical activity and sport is the main cause of the onset of obesity and type II diabetes.

The objective of this work is to study the level of the practice of physical activities and sports in the school environment, among the pupils of 13-18 years and the relation of this practice with the two pathological phenomena

(obesity, diabetes of type II) in the wilaya of Bejaia. The prevalence of obesity in school children is years old (Lecerf.MF, 2005), obesity is considered a real "epidemic", even a "time bomb" since obesity in children tends to continue into adulthood (Bovet P, 2008); (Assathiany.R, 2003) .

The study involved a sample of 110 students (55 boys and 55 girls) aged between 13 and 18 years, enrolled in middle and secondary school in several establishments in the wilaya of Bejaïa selected according to the availability of our sample.

1. Material and method

1.1 Measurement of anthropometric parameters :

Anthropometric parameters (weight and height) were measured using a scale and a measuring rod. The body mass index (BMI) was calculated according to the Quételet formula (weight KG /height2 (M^2).

For children under 18 years of age, the values obtained are plotted on reference body weight curves, to enable the weight status of a child to be determined according to age and sex. In contrast, adults have a single reference BMI value.

1.2 Weight status classifications :

Obesity in adults is considered to be when the BMI is greater than 30 kg/m².

Table N°1. Classification of adult weight status according to the WHO

Classes	IMC (Kg /m^2)	Accroissement du risque Encouru
Poids normal	18.5 à 25 Kg /m^2	De référence (Nul)
Surpoids	25 à 30 Kg/m^2	Un peu augmenté
Obésité modérée	30 à 35 Kg/m^2	Facteur 1.5 à 2
Obésité sévère	35 à 40 Kg/m^2	Facteur 3 à 4
Obésité morbide	Supérieur à 40 Kg/m^2	Facteur 5 à 6

The values obtained for children under 18 years of age are presented in the reference body weight curves. Depending on the age and sex of the children, it is known whether the child is obese or not, if the value exceeds the 97th percentile of the body weight curve, i.e. if the BMI is greater than 30 kg/m². (Obesity of degree 2), but, adults only BMI (reference value).

2. Diabetes type II :

We screened for type II diabetes by questioning obese students and also on their ages of reaching type II diabetes.

The average $\overline{X}$ was used to determine the age of onset of type II diabetes, for each age group for girls and boys. 13 to 15 years 16 to 18 years

2.1. Physical activity level PAL :

This is an estimate of the number of hours spent per day on each type of activity, averaged over the duration of these activities recorded over a week. The more accurate the estimate, the closer the calculated **PAL** will be to reality.

2.2 Questionnaire :

We used the self-assessment questionnaire of the weekly physical activity level, carried out by (J.Ricci and L.Gagnon, University of Montreal, modified by F.Laureyns and JM.Séné).

The questionnaire contains nine questions divided into three items (sedentary behaviours, leisure time physical activities and daily physical activities), and the answers are given in the form of a scale from 1 to 5.

2.2.1 Questionnaire protocol :

After answering all the questions, the score obtained for each question (1 to 5) is reported and then the total is calculated.

Less than 18 points, the subject is sedentary: the level of physical activity is below the recommendations.

Between 18 and 35 points, the subject is active: the level of physical activity is within the recommended standards for good health.

More than 35 points, the subject is very active: the level of physical activity not only allows to stay healthy, but also, to improve the general physical condition.

3 Statistical analysis :

The results are expressed as averages, the correlation between NAP and BMI is done by Pearson's test, performed with Microsoft office Excel.

4. presentation and discussion of the results :

Result

Table N°2. Age of onset of type II diabetes for each age group in obese boys and girls.

Boys			Girls		
Tranches d'âge	Age du diabète	Ecart-type	Tranches d'âge	Age du diabète	Ecart-type
De 13 à 15 ans	11	1,36	De 13 à 15 ans	11	1,44
De 16 à 18 ans	14	1,68	De 16 à 18 ans	13	1,54

Table 02 shows that the age of onset of diabetes is 11 years with ± 1.36 for boys aged 13 to 15 years, for girls the age of onset of diabetes is 11 years with ± 1.44 for girls aged 13 to 15 years, Indeed, we can say that the age of onset of diabetes for girls and boys (13 to 18 years) varies between 11 and 15 years.

Discussion

An increasingly early complication is type II diabetes, which used to be encountered only in the fifties and now increasingly appears in adolescence (Rocchini.AP., 2002). According to the results, obese girls and boys are found to have type II diabetes at an early age, which is considered to be an epidemic very often associated with excess weight.

Result:

Table 3. BMI values of obese and diabetic boys and girls from 13 to 18 years.

Boys					Girls				
Age	Taille(m)	m^2	Poids kg	IMC kg /m^2	Age	Taille m	m^2	Poids kg	IMC kg /m^2
13	1,57	2.47	66.8	27	13	1.52	2.50	58.4	25.4
14	1,66	2.70	70.5	27.2	14	1.61	2.58	68.4	26.5
15	1,60	2.59	74.25	28.8	15	1.57	2.49	66.5	26.8
16	1,67	2.8	79	28.2	16	1.59	2.54	69.6	27.3
17	1,72	2.99	86.83	29	17	1.64	2.68	73.25	27.3

| 18	1,75	3.07	92.38	30.1	18	1.61	2.59	78.28	30.2

Table 03 and the body shape curves above represent the body mass index (BMI) of obese boys and girls aged 13 to 18. The growth of BMI with age, height and weight is observed. In boys, a 13 year old who is 1.57m tall and weighs 66.8kg has a BMI = 27kg/m2, whereas an 18 year old who is 1.75m tall and weighs 92.38kg has a BMI = 30.1kg/m2. In girls, a 13 year old who is 1.52m tall and weighs 58.4kg at a BMI of

In contrast, an 18-year-old subject who is 1.61 m tall and weighs 78.28 kg has a BMI of 30.2 kg/m2.

Discussion

From the above results it can be said that age, height and weight play an important role in the increase of the body mass index (BMI). The body shape curves and the WHO classification when BMI is used in child monitoring, allowed us to classify the children according to their body shape. The curves (I & II) above show that the child is obese if the BMI is above the 97th percentile (ANAES, 2003).
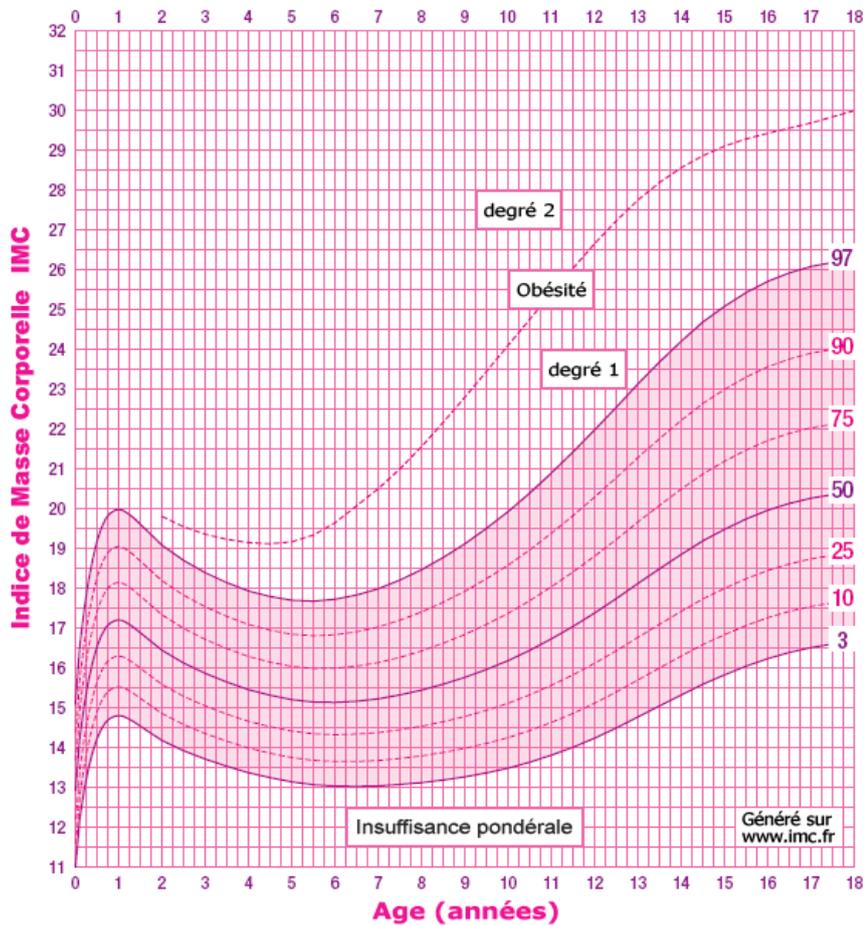
Figure No. 1: Body weight curve of obese and diabetic boys aged 13 to 18
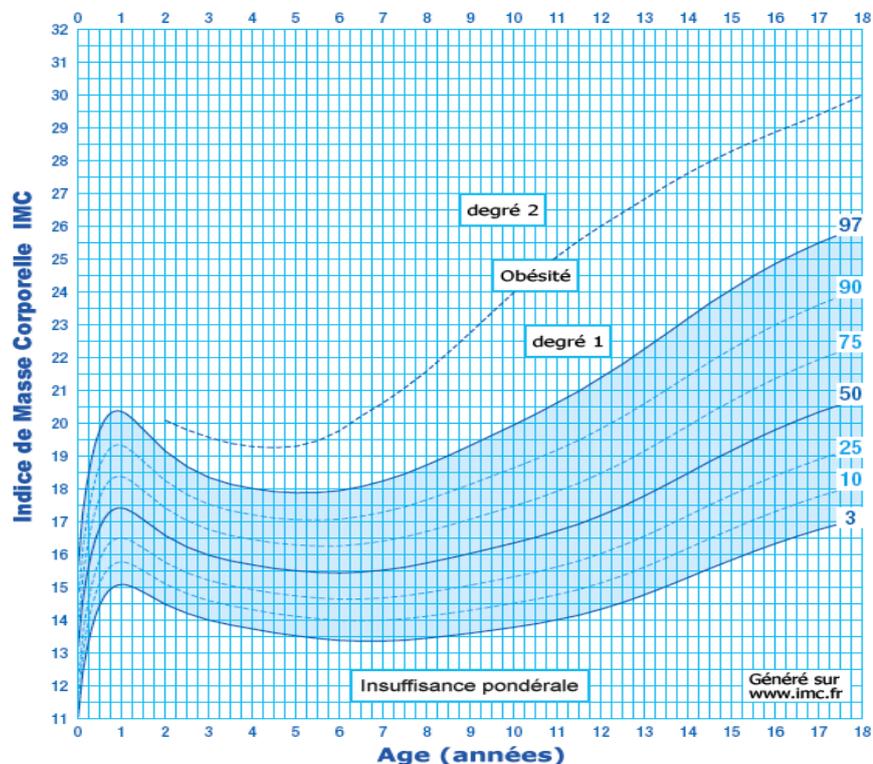
Figure 2. Body weight curve of obese and diabetic girls aged 13 to 18

From the above results it can be said that age, height and weight play an important role in the increase of the body mass index (BMI). According to the WHO classification, an 18 year old can be considered obese when his or her BMI is 30 kg/m2.

Result :

Table 4. NAP and BMI values of obese and diabetic boys from 13 to 18 years old

Boys					
Age	NAP (points)	IMC kg/m^2	Age	NAP (points)	IMC kg/m^2
13	23.6	27	16	17.4	28.2

14	19.8	27.2	17	16	29
15	18.3	28.9	18	16	30.1

Table 04 and the curves above represent the body mass index (BMI) and physical activity level (PAL) of obese boys aged 13-18.

(BMI) and physical activity level (PAL) of obese boys aged 13 to 18 years. The increase in BMI and the decrease in PAL are observed with advancing age. A 13 year old has a BMI of 27 kg/m2 and a NAP of 23.6 points, while an 18 year old has a BMI of 30.1 kg/m2 and a NAP of 16 points.

In figures 03 and 04 the above curves show the increase in BMI and the decrease in NAP with advancing age. In boys, an 18 year old subject has a BMI of 30.1 kg/m2 and a NAP of 15.3 points, a 13 year old subject has a BMI of 27kg/m2 and a NAP of 23.6 points, while a 15 year old subject has a BMI of 28.9 kg/m2 and a NAP of 18.3 points.

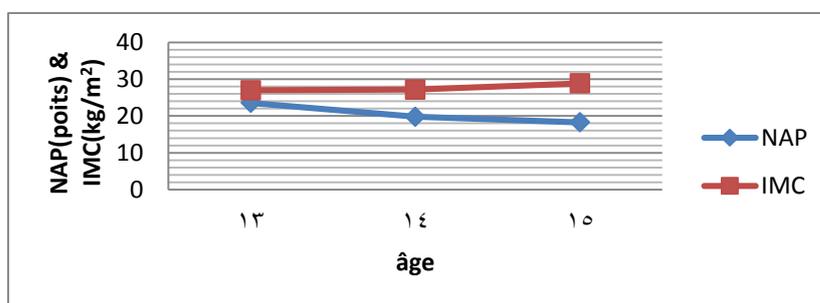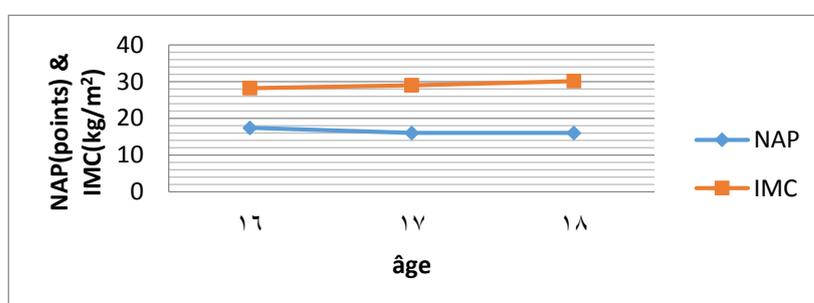Figure 3: Evolution of NAP and BMI values of obese and diabetic boys from age 13 to 15

Figure N°4. Evolution of NAP and BMI values of obese and diabetic boys from 16 to 18 years

Discussion

 Regarding weight control, different data indicate that the risk of developing obesity is directly related to the level of physical activity in children

(Moore.LL, et al., 2003) and in adults (Hu FB. & al, 2003).

From the above results, it can be said that as age advances, NAP decreases to inactive subjects and BMI increases with a tendency to morbid obesity.

Results

Table N°5: NAP and BMI values of obese and diabetic girls from 16 to 18 years old

| Age (Girls)	**PAL** (points)	IMC kg/m^2
16	16.2	27.3
17	15	27.3
18	13	30.2

In table 05 and the curves above we see the increase in BMI and the decrease in NAP with advancing age. A 16 year old subject had a BMI of 27.3 kg/m2 and an NAP of 16.2 points, and an 18 year old subject had a BMI of 30.2 kg/m2 and an NAP of 13 points.

Discussion

Regarding weight control, different data indicate that the risk of developing obesity is directly related to the level of physical activity in children (Moore.LL, et al., 2003) and in adults (Hu FB. & al, 2003).

From the above results, we can say that, as age advances, the NAP decreases, to have inactive subjects and the BMI increases with a tendency to morbid obesity.

Figure N°5: Evolution of NAP values and obese and diabetic girls from 16 to 18 years old.
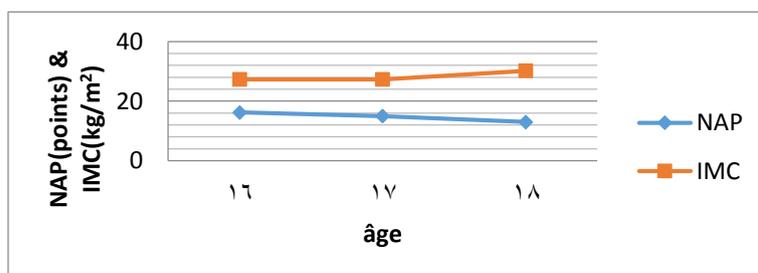
Results of the correlation test between BMI and PAL :

Table N°6. Correlation between PAL and BMI of diabetic boys and girls from 13 to 15 years old

Boys				Girls			
Variable	Mean	Type d'Ecart	Correlation index (R	Variable	Mean	Ecart-type	Correlation index (R
PAL	20,57	2,73	-0 ,78	**PAL**	18,83	3,85	-0,96
IMC	27,67	1,04		IMC	26,23	0,73	

Table 7. Correlation between NAP and BMI of diabetic boys and girls aged 16 to 18

Boys				Girls			
Variable	Mean	Type d'Ecart	Correlation index (R)	Variable	Mean	Type d'Ecart	Correlation index (R
PAL	16,47	0,81	-0,81	**PAL**	14,73	1,61	-0,92
IMC	29,11	0,95		IMC	28,27	1,67	

The results

The correlation results in Tables 5-6 and 07 show that there is a strong, inversely proportional (decreasing) correlation between low physical activity level (PAL) and very high body mass index (BMI).

Discussion

In fact, as the level of physical activity decreases towards a sedentary lifestyle or even inactivity, the body mass index tends to reach morbid obesity and develop associated co-morbidities such as type II diabetes. The morbidity-mortality curve as a function of BMI is a hyperbolic curve: therefore, losing relatively little weight already allows us to gain a lot in terms of morbidity-mortality, particularly in individuals with severe obesity (Després JP & al, 2001).

The most important risk factor for the development of type 2 diabetes is a high BMI (greater than 30 kg/m2 regardless of body fat distribution) (Scheen AJ.

Acta Clin Belg, 2000); (Hu F & al., 2001).

4. Conclusion:

Obesity is the major global health concern, with few effective treatments available. The recent increase in the number of overweight people in both developed and developing countries is the result of significant changes in physical activity behaviours.

The results of our survey show that there is a relationship between the level of physical activity and sport (**PAL**) and the onset of metabolic diseases such as obesity and diabetes type II, the subjects studied have a low level of physical activity, they are increasingly sedentary, which leads them to frequent these two epidemics, which are acquired conditions, nobody is born with.

Type II diabetes is a worrying health issue, due to its ever-increasing prevalence in children in recent years, and in most cases it is linked to obesity. At present we can see that obesity and type II diabetes in children are slow to take hold and very difficult to combat once they are declared.

Lack of physical activity has become a problem that is spreading faster, especially in the conditions of our society, where man has become dependent on the machine, and the lack of dependence on his physical activity, and thus man has lost one of his most important functions as an organism that moves with its effort from one place to another.

It is known that there are several reasons that contribute to the increase in the incidence of obesity, and these problems are increasing in a worrying way, not only because they affect a high percentage of people, but also because they have started to appear at an early stage. Age that is supposed to be the most productive age in the world. Human age . (Raouan Mohamed, 2020. p192).

In recent times it is affecting the youngest population, or a large number of children growing up in these countries are at risk of becoming obese early in life, and developing associated co-morbidities, such as type II diabetes which is considered a major health problem and its prevalence is increasing.

Comparing the prevalence of obesity between different countries of the world is not a simple matter. The complexity lies in the methodology and variability of the criteria used to define obesity. Similarly, comparing results from different studies is hampered by the fact that the size of the individuals and

their age and sex distribution are not statistically comparable. (Belounis R&al.,2019)

It seems important to remember that our genome and our organism are organised within the framework of an active human being, where the evolution of sedentary life in our societies has favoured the development of new and even unknown pathologies, such as type II diabetes in children.

It is important to fight against this de-training. In young people, Must and Tybor conclude from prospective studies that increasing physical activity and reducing sedentary behaviour is protective against weight gain in children and adolescents (Must.A & Taybor.DJ, 2005).

There is an urgent need to address these two epidemics and to put in place strategies, through environmental design, awareness campaigns towards students, parents and institutions, on the importance of physical activity and its recommended programmes and also to reform by increasing the hourly volume of school PE, to give more importance to this essential subject, in order to preserve the health of our children and adolescents.

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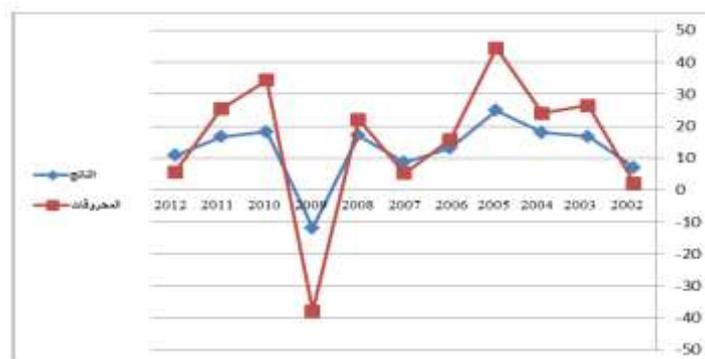24- R., Assathiany. (2003). *Le pédiatre doit prévenir l'obésité de l'enfant.* (éd. Médecine & enfance).

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Table 1. Table title (this is an example of table 1)

Test 1	Test 2	Results 1	Results 2	Total Results
15.21	15.21	15.21	15.21	15.21
18.58	18.58	18.58	18.58	18.58
11.14	11.14	11.14	11.14	11.14

Source:author's name, year, page

Fig.1. Figure title (this is an example of figure 1)

4. CONCLUSION

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5. Bibliography List :

Use the « APA Reference System », see the link :

https://www.youtube.com/watch?v=AmiKblUQs_A

The references must be directly quoted in the body of the text (eg: ... (Brown, 2006, p35), without omitting to mention the complete reference in the list of references at the end of the document, written in the following manner:

1. **Books :** author's name (year), full title, publishing, country;
2. **Theses:** researcher(year), thesis title, college, university, country ;
3. **Journal article :** author's name (year), full title of the article, review name, place, volume and number, page ;
4. **Seminar article:** author's name (year), full title of the paper, title of seminar, place and date, country ;
5. **Internet websites:** author's name (year), full title of the file, detailed web site :http://fulladdress (consulted on day/month/year).

6. Appendices

Important Notes

- The volume of the research article should not exceed **30 pages**, and not be less than **15 pages**.