THE ASSESSMENT OF THE GLUCOSE METABOLISM DISTURBANCES IN NORMOLIPIDIC AND DYSLIPIDAEMIC PATIENTS

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Abstract

The goal of the study*: to evaluate glucose metabolism disturbances in a group of normolipidaemic patients (NLP) comparing with a group of dyslipidaemic patients (DLP).* ***Design and methods****: we investigated a group of 120 NLP and a group of 120 DLP. We also performed the glucose oral tolerance test (GOTT), in order to evaluate glucose metabolic dissorders.* ***Results and discussions****: analizing glucose metabolic dissorders in NLP and DLP, we observed the presence in a bigger percentage of normoglycaemia (NG) in NLP and a bigger percentage of diabetes mellitus (DM) in DLP. The mean of impared fasting glycaemia (IFG) and 2 hours postmeal during GOTT were statisticaly significant bigger in DLP. There were no differences between sex, except the patients with DM, in which we observed a high frequency in the female. Analizing the average age, for both groups, taking into consideration the glucose tolerance degrees, we noticed that there is a huge and important difference between NG-DM in both groups. Also, analizing the average age in the subgroups IFG-IGT (Impaired Glucose Tolerance), IFG-DM, IGT-DM we noticed noteworthy differences only in the DLP group.* ***Conclusions****: there were high disturbances of the glucose metabolism in DLP group. There weren`t differences between gender, according to the glucose perturbations degrees in the studied groups excepting DM patients, where we noticed a stressed glucose perturbation in the female. Looking carefully at both goups, there weren`t any perturbations at young ages.*

Key words*: diabetes, dyslipidaemia, impaired fasting glycaemia, impaired glucose tolerance, atherosclerosis.*

Background

IFG worldwide, is around 8,2% and we expect an increse to 9% until 2025. IGT is presented in 197 milions of persons. In 2007, type 2 DM prevalence was 7,3% in adults between 20-79 years old [1]. The fast increasing of the worldwide prevalence of the DM, especially type 2 diabetes, has a major impact on cardiovascular mortality and morbidity. The cardiovascular diseases is the main cause for the worldwide mortality and morbidity. Both dyslipidaemia and the glucose metabolism disorders play an important role in how these diseases occur [2].

The cardiovascular risk is high even before prediabetes and is stressed in a progressive way in the same time with the prediabetes appearance.

The macrovascular disease seems to appear before the onset of DM, being emphasized in prediabetes; many studies are proofing the relevance of the postprandial hyperglycaemia in the precocious appearance of the atherosclerosis, so they are proofing the increase of the cardiovascular risk [4].

A study published by Haffner in 1998 and confirmed by Schramm in 2008 demonstrated that the cardiovascular risk for type 2 DM is similar with one of those who have personal hystory of cardiovascular disease without DM, type 2 DM being considered "an equivalent coronary risk" [5].

A main part of the cardiovascular risk find in diabetes and in prediabetes is due to the associated dyslipidaemia [6].

The insulin decrease and/or insulinresistance in different proportions in diabetes patients determine both quantitive and qualitive modifications at all the lipoproteic classes. But, the dyslipidaemia in diabetic patients is more frequently in comparison with entirely population. Thereby, if this is seen in 20% of nondiabetic population, the presence of the dyslipidaemia in diabetic patients may reach even 70% [7]. Although there are certain modifications in all the lipoproteic classes, the patients with diabetes are characterized by triglyceride metabolism dissorders (hypertriglyceridaemia and HDL cholesterol decrease), proportionally with the unbalanced metabolic degree.

Material and Methods

In 2008, we investigated two groups of patients (one group of 120 DLP and a control group, of 120 NLP) who were registrated at their GP's in Craiova. Inclusion criterions: age between 20 and 80; fasting glycaemia under 126 mg/dl, no antidyslipidaemic treatment. Exclusion criterions: prior diagnosed DM, pregnancy, gastrointestinal resections, high level of stress (surgeries, traumatisms, inflammatory process, recent stroke, recent AMI); treatment with glucocorticoids, thiazide diuretics, estrogens, salicylates, thyroid hormones; chronic renal failure, renal transplant, chronic nephropathy, neoplasia, cirrhosis, systemic lupus, and psychical diseases.

We registered personal history and anthropometric parameters: weight, height, waist and hips circumference. We calculated the value of the waist/ hip ratio, BMI, the value of the insulin resistance (HOMA-IR).

Plasmatic values of the glycaemia have been determined through enzymatic method, insulinemia through electrochemilumines-cence method on ELECSYS 1010 screen, the value of total cholesterol, triglycerides through enzymatic method, HDL cholesterol through precipitation method and LDL cholesterol through Friedwald formula (when the value of the triglyceride was < 400 mg/dl).

We performed GOTT with 75g glucoses, thereby determined the fasting glycaemia and glycaemia at 2 hours after giving glucoses. We measured the arterial pressure and we also registrated an ECG. IMT was determined at the common right and left carotid artery level, through ultrasounds Doppler (B model). The illustrative presentation of NLP group (table 1) and DLP group (table 2)

Table 1. Characteristics of the NLP Group

Feature	Average	Standard deviation	Variation Coeficient
Age (years)	51,74	13,84	26,74
Abdominal circumference [cm]	94,43	12,89	13,65
Body mass index [kg/m^2]	27,72	4,94	17,83
Fasting glycaemia [mg/dl]	105,53	17,18	16,28
2 hours pp Glycaemia [mg/dl]	131,41	43,77	33,31
Total cholesterol [mg/dl]	168,18	17,54	10,43
LDL cholesterol [mg/dl]	93,68	17,43	18,61
HDL cholesterol [mg/dl]	52,60	7,77	14,77
Triglyceride [mg/dl]	110,80	29,56	26,68
Insulinemia [μU/ml]	9,80	5,04	51,39
HOMA IR	2,54	1,37	54,04
Sistolic arterial pressure [mmHg]	128,79	19,78	15,36
Diastolic arterial pressure [mmHg]	78,63	14,39	18,30
Intima media thickness – right CCA [mm]	0,74	0,09	11,68
Intima media thickness – left CCA [mm]	0,75	0,09	11,79

Table 2. Characteristics of the DLP group

Feature	Average	Standard deviation	Variation coeficient
Age (years)	54,03	10,84	20,06
Abdominal circumference [cm]	98,71	10,95	11,09
Body mass index [kg/m^2]	29,61	4,97	16,79
Fasting glycaemia [mg/dl]	112,34	18,86	16,78
2 hours pp Glycaemia [mg/dl]	158,31	67,71	42,77
Total cholesterol [mg/dl]	229,99	48,05	20,89
LDL cholesterol [mg/dl]	144,03	49,73	34,53
HDL cholesterol [mg/dl]	46,37	13,24	28,54
Triglyceride [mg/dl]	186,13	74,10	39,81
Insulinemia [μU/ml]	11,11	4,66	41,97
HOMA IR	3,08	1,35	43,71
Sistolic arterial pressure [mmHg]	134,25	17,78	13,25
Diastolic arterial pressure [mmHg]	80,11	12,18	15,21
Intima media thickness –right CCA [mm]	0,77	0,08	9,90
Intima media thickness – left CCA [mm]	0,78	0,08	9,91

Statistical analysis: we use software EPI 2000, distributed by OMS, SPSS, specialized in statistical scientific calculations, produced by SPSS.

We recorded the patients` data using Excel. The tables of incidence were appreciate from the point of view of the dependence of the two classification elements using CHI PATRAT test, and keeping only the results less than 5%, an enough condition.

Results

After performing GOTT, we divided the 2 groups of patients according to the alteration of glucose metabolism, in subgroups: NG, IFG, IGTN and DM (table 3, fig.1) We notice that:

– 47,50% of NLP group (57 patients) and 31,67% from DLP group (38 patients) were NG
– 15,83% of NLP group (19 patients) and 17,50% from DLP group (21 patients) were IFG
– 25,83% of NLP group (31 patients) and 26,67% from DLP group (32 patients) were IGT
– 10,83% from NLP group (13 patients) and 24,17% from DLP group (29 patients) were with DM

Table 3. The distribution of the two groups according to the glucoses tolerance

	NL		DLP	
	Nr.	%	Nr.	%
NG	57	47,50	38	31,67
IFG	19	15,83	21	17,50
IGT	31	25,83	32	26,67
DM	13	10,83	29	24,17

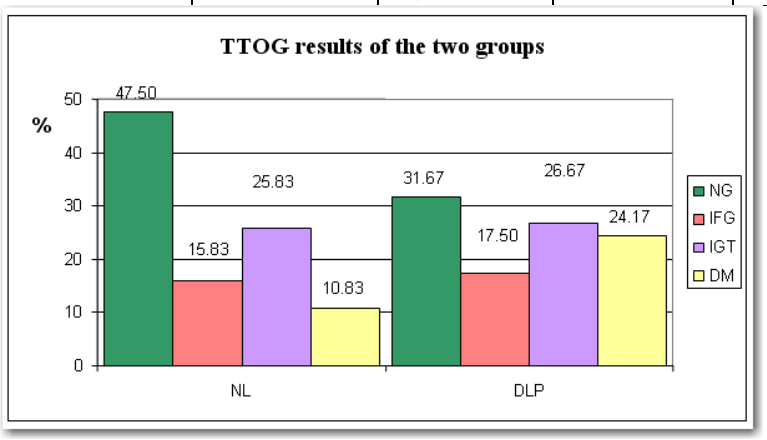

Fig. 1. GO TT results of the two groups

Making CHI PATRAT test we get 10,011, value which outgrow 95%, which means 7,81. This thing let us state that there is a certain dependence , a significant link, from statistic point of view, between patient`s dyslipidaemia and the seriousness of the modified glucose tolerance (Table 4).

Table 4. CHI PATRAT test on both of groups

Patients` number	NL	DLP	Total
NG	57	38	95
IFG	19	21	40
IGT	31	32	63
DZ	13	29	42
Total	120	120	240

Chi patrat	10,011		level	7,81	11,34
				95%	99%

Comparing fasting averages glycaemia (Table 5) and 2 hours pp glycaemia (Table 6) for NLP and DLP through Student Test, we find p=0,0037 and p=0,0003, so smaller values than 0,01 (which means 1%) , and these information show us that there is a certain difference from statistic point of view between glycaemic average of both of groups (Fig. 2).

Table 5. The fasting average glycaemic in both groups

Fasting glycaemia	NL	DLP
Average	105,53	112,34
Std. Dev.	17,18	18,86
CV	16,28	16,78
P	0,0037	

Table 6. The 2 hours pp average glycaemia in both groups

Glycaemia at 2 hours	NL	DLP
Average	131,41	158,31
Std. Dev.	43,77	67,71
CV	33,31	42,77
P	0,0003	

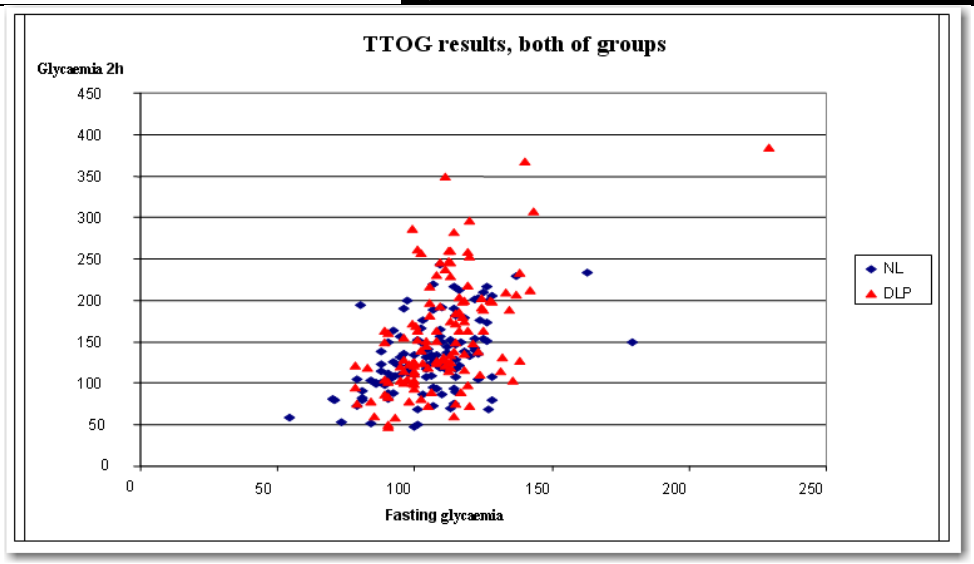

Fig. 2 –GOTT results, in both groups

Comparing the average of the fasting glycaemia using the glucoses tolerance degrees, in NG (p=0,5406), IFG (p=0,1300), IGT (p=0, 5635) and DM patients (p= 0, 5580) we noticed that there weren't any differences between these two groups (Table 7).

We studied also the two hour average glycaemia from OGTT and we correlated it with degrees of glucoses tolerance and we noticed that DM group (comparing NL-DM with DLP-DM, so the same degree of modified glucoses tolerance) showed a higher difference from statistic point of view in patients with DLP (p=0,0003), proofing the influence of the dyslipidaemia (Table 8).

Table 7. The average fasting glycaemia in the two groups and their subgroups

	NL-NG	DLP-NG	NL-IFG	DLP-IFG	NL-IGT	DLP-IGT	NL-DM	DLP-DM
Average	94,12	95,37	117,26	120,81	112,13	114,25	122,62	126,34
Std. DEv	11,72	8,05	5,87	8,48	16,85	11,53	16,09	23,97
C.V.	12,45	8,44	5,00	7,02	15,03	10,09	13,12	18,97
P	0,5406		0,1300		0,5635		0,5580	

Table 8. Average glycaemia 2 hours post GOTT in DM patients

	NL_DM	DLP_DM
Average	214,46	253,97
Std. Dev.	13,84	48,91
C.V.	6,45	19,26
P	0,0003	

Comparing the two hour average glycaemia from OGTT in the other degrees of glucoses tolerance, there weren`t any differences between the subgroups: NG (p=0,4598), IFG (p=0,3662) and IGT (p=0,0739) (Table 9).

Table 9. Average glycaemia 2 hours post GOTT in patients with NG, IFG, IGT

	NL_NG	DLP_NG	NL_IFG	DLP_IFG	NL_IGT	DLP_IGT
Average	104,02	100,32	106,95	113,67	161,94	169,78
Std. Dev.	24,75	23,14	23,54	22,82	17,03	17,21
C.V.	23,79	23,07	22,01	20,07	10,52	10,14
P	0,4598		0,3662		0,0739	

Analyzing the patients` distribution by gender we notice that patient with DM , both NLP and DLP, are more female ( Table 10.a. and 10.b., Fig.3); at the other degrees of glucoses tolerance there weren`t any gender distribution differences.

Table 10.a. Gender Distribution in studied groups and subgroups

	NL_NG		NL_IFG		NL_IGT		NL_DZ	
	Nr	%	Nr	%	Nr	%	Nr	%
T	57	47,5	19	15,8	31	25,8	13	10,8
M	24	20,0	9	7,5	18	15,0	3	2,5
F	33	27,5	10	8,3	13	10,8	10	8,3

Table 10.b. Gender Distribution in studied groups and subgroups

	DLP-NG		DLP-IFG		DLP-IGT		DLP-DM	
	Nr	%	Nr	%	Nr	%	Nr	%
T	38	31,7	21	17,5	32	26,7	29	24,2
M	20	16,7	11	9,2	16	13,3	13	10,8
F	18	15,0	10	8,3	16	13,3	16	13,3

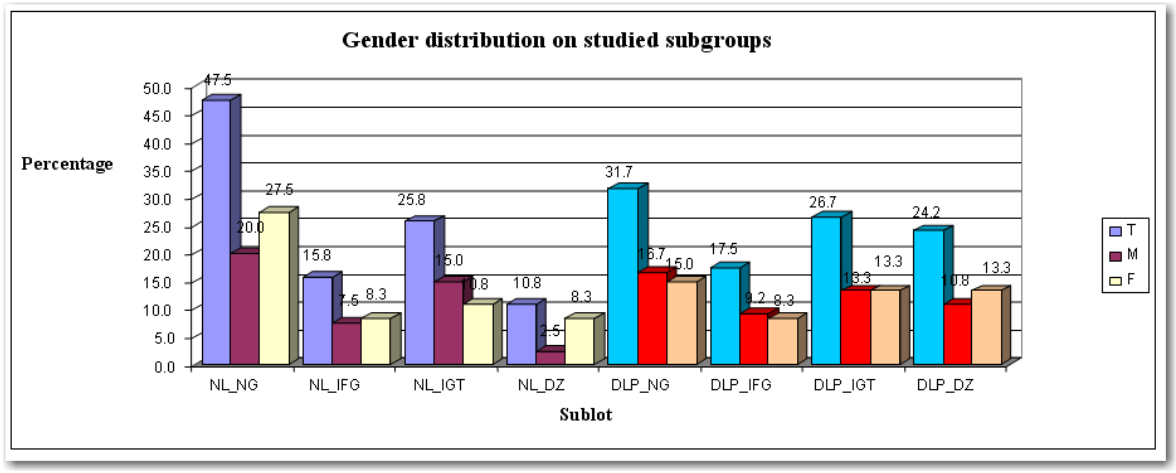

Fig. 3 – Gender distribution on studied subgroups

Analyzing the age distribution in NLP and DLP groups we notice that the average age in NLP was 51,74 years old and in DLP it was 54,03 years old. Comparing the groups through Student Test: p=0,1539 value, without statistical significance (Table 11, Fig. 4)

Table 11. Average age distribution in NLP and DLP groups

	NL	DLP
Average	51,74	54,03
Dev.std.	13,84	10,84
C.V.	26,74	20,06
P	0,1539	

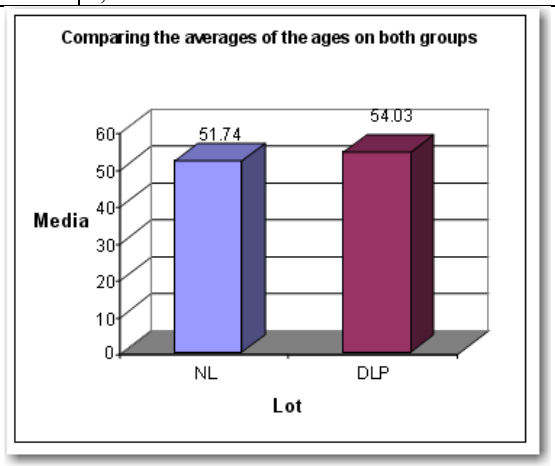

Fig. 4. Comparing the averages ages on both groups

Analyzing the age distribution according to the modified glucoses tolerance there weren`t any significant differences from a statistic point of view at groups NG (p=0,0927), IFG (p=0,2899), IGT(p=0,8239), DM (p=0,6852) (Table 12, Fig. 5)

Studying the age distribution in NL group according to the degree of modified glucoses tolerance, we notice that comparing the subgroups NG_IFG, NG_IGT, NG_DM through Student Test we didn't find any statistical significante diferences, excepting subgroup NG_DM, where there was a high

difference from statistic point of view between average ages, between subgroups (p=0,004) (Table 13).

Tabel 12. Comparing the average ages accorging to the modified glucoses tolerance

	NL-NG	DLP-NG	NL-IFG	DLP-IFG	NL-IGT	DLP-IGT	NL-DM	DLP-DM
Average	48,09	52,37	55,23	50,81	53,46	52,78	58,54	59,93
Dev.std.	13,31	11,08	14,22	11,47	14,52	8,71	10,03	10,47
C.V.	27,69	21,16	25,75	22,57	27,16	16,50	17,13	17,47
P	0,0927		0,2899		0,8239		0,6852	

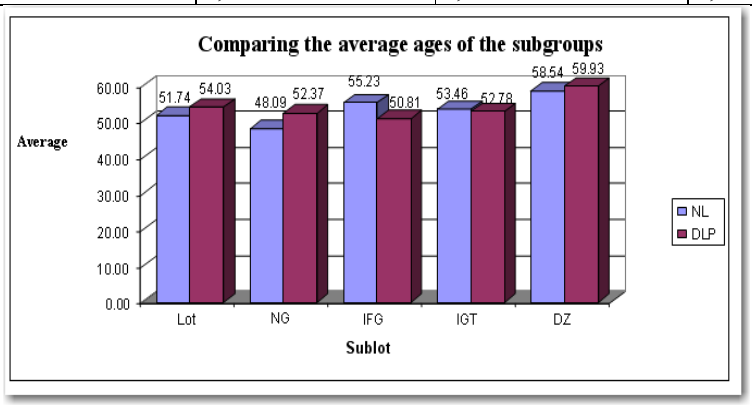

Fig. 5 – Comparing the average ages of the subgroups

Table 13. Comparing the average ages in NLP group and subgroups: NG-IFG, NG-IGT, NG-DM

	NL_NG	NL_IFG	NL_NG	NL_IGT	NL_NG	NL_DM
Average	48,09	55,23	48,09	53,46	48,09	58,54
Dev.std.	13,31	14,22	13,31	14,52	13,31	10,03
C.V.	27,69	25,75	27,69	27,16	27,69	17,13
P	0,0640		0,0934		0,0042	

There weren` t any significant differences from a statistic point of view after the analyzing of the average ages in subgroups IFG-IGT (p=0,6742), IFG-DM (p=0,4460) and IGT-DM (p=0,1922) (Table 14).

Table 14. Comparing the average ages on group NLP and subgroups IFG-IGT, IFG-DM, IGT-DM

	NL-IFG	NL-IGT	NL-IFG	NL-DM	NL-IGT	NL-DM
Medie	55,23	53,46	55,23	58,54	53,46	58,54
Dev.std.	14,22	14,52	14,22	10,03	14,52	10,03
C.V.	25,75	27,16	25,75	17,13	27,16	17,13
P	0,6742		0,4460		0,1922	

Studying the age distribution of DLP group according to the degree of modified glucoses tolerance, we noticed that through the study of the subgroups NG-IFG, NG-IGT, NG-DM using Student Test we didn't find any statistical significante diferences, excepting

subgroup NG_DM, where there was a high difference from statistic point of view between average ages between subgroups. We found p=0,0058, so a smaller value than the key one, 0,01 (which means 1%) (Table 15).

Table 15. Comparing the average ages in group DLP and subgroups NG-IFG, NG-IGT and NG-DM

	DLP-NG	DLP-IFG	DLP-NG	DLP-IGT	DLP-NG	DLP-DM
Average	52,37	50,81	52,37	52,78	52,37	59,93
Dev.std.	11,08	11,47	11,08	8,71	11,08	10,47
C.V.	21,16	22,57	21,16	16,50	21,16	17,47
P	0,6157		0,8621		0,0058	

Comparing the average ages in DLP group and in subgroups IFG-DM through Student Test we found p=0,0063, so a smaller value than the key one, 0,01(which means 1%); it shows us that there is a certain differences from a statistic point of view between average ages. Also, studying the average ages of the subgroups IGT-DM we found p=0,0056 value, and that shows us a certain difference from a statistic point of view. There weren`t any significant difference studying the subgroups IFG-IGT (p=0,5066) (Table 16).

Table 16. Comparing the average ages in group DLP and subgroups IFG-IGT, IFG-DM and IGT-DM

	DLP-IFG	DLP-IGT	DLP-IFG	DLP-DM	DLP-IGT	DLP-DM
Medie	50,81	52,78	50,81	59,93	52,78	59,93
Dev.std.	11,47	8,71	11,47	10,47	8,71	10,47
C.V.	22,57	16,50	22,57	17,47	16,50	17,47
P	0,5066		0,0063		0,0056	

Conclusions

Through GOTT we analyzed the perturbation of the glucidic metabolism in the NLP and DLP and we notice that 46,5% from NLP group are normoglycaemics and only 31,67% from DLP group are the same.

DM presence has been noticed to be 10,83% in NLP group and 24,17% in DLP one.

Analyzing the IFG and IGT presence in both groups, these were presented in 15,83% at NLP group and 17,5% in DLP one for IFG and 25,83% in NLP group and 26,67% at DLP group for IGT. Making the CHI PATRAT test we find 10,011 value which overdraw the condition value, 95%, which means 7,81. This thing let us say that there is a certain connection, a significant link from a statistic point of view between the existence of the dyslipidaemia in a patient and the seriousness of the modified glucoses tolerance.

We analyzed the average of the fasting glycaemia and of the glycaemia at 2 hours in GOTT and we notice that there is a high difference from a statistic point of view between the two groups; in DLP group we proved the lipid perturbations.

Analyzing the gender distribution of the two groups according to the degree of the modified glucoses tolerance we notice that only the DM patients is a certain difference between gender, meaning that the female are more affected.

Analyzing the average ages in NLP and DLP groups there weren`t any significant differences from a statistic point of view. Through comparing the subgroups NG-IFG, NG-IGT, NG-DM according to the average ages we found that at the NLP group as well as DLP one there were significant statistic differences only though the parallel of the subgroups NG-DM.

Analyzing the average ages of the subgroups IFG-IGT, IFG-DM, IGT-DM weren`t any significant differences from a statistic point of view at NLP group, but at DLP group there were very important ones through the parallel draw between the subgroups IFG-DM and IGT-DM.

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