

# CEPHRIS

## A Comparison of Illawarra Division's Diabetes Data (TAADIS) with the National Division's Diabetes Program Aggregated Diabetes Data (NDDP)

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Health Research in Illawarra and Shoalhaven

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## **LIST OF ABBREVIATIONS:**

ABS	Australian Bureau of Statistics
BMI	Body Mass Index
BP	Blood Pressure
CVA	Cerebrovascular Accident
DBP	Diastolic Blood Pressure
HbA1c	Glycated Haemoglobin A1c
HDL	High Density Lipoprotein
IDGP	Illawarra Division of General Practice
LDL	Low Density Lipoprotein
MI	Myocardial Infarction
NDDP	National Division Diabetes Program
SBP	Systolic Blood Pressure
TAADIS	The Automated Accessible Diabetes Information System
T-CHOL	Total Cholesterol
TG	Triglyceride

## **EXECUTIVE SUMMARY**

This study compared the diabetes data collected during 2000-2002 from TAADIS (The Automated Accessible Diabetes Information System) and NDDP (National Division Diabetes Program). Collected data which were comparable and available were studied and changes in the clinical indicators identified. The NDDP includes aggregated data from its CARDIAB program. This is a database designed for use by Divisions of General Practice which focuses on cardiovascular and diabetes management within the primary health care system and enables collation of data on patients enrolled in the Division's programs. TAADIS was developed and operated by the Illawarra Division of General Practice (IDGP) and its GPs. It is an information management program that provides a framework for diabetes management by expanding access to diabetes patient's information to health providers and patients, educating GPs in the best management of diabetes and encouraging patient adherence to clinical management guidelines.

This is a secondary analysis of data collected for two separate evaluations. Full ethics committee clearance was obtained for both studies. The numbers of participant diabetes patients in TAADIS were: 313, 438 and 527 in the years 2000, 2001, and 2002 respectively and in NDDP they were: 9268, 11454, and 15294 respectively. The number of patients on the registers increased over the three years in both groups, but the frequency of assessments declined slightly.

A cohort analysis was carried out for 3002 patients in NDDP and 248 in TAADIS who had seen a GP at least once in each of the 3 years. The number of tests conducted for clinical indicators varied between the groups. The TAADIS group had more results for Lipid and HbA1c but NDDP had more results for BP and BMI. The TAADIS records on average had 3 blood pressure measures and 2 tests for other clinical indicators per year.

In the NDDP, blood pressure, LDL, T-CHOL, TG, and HbA1c reduced significantly within the groups but changes in HDL were not statistically significant. In TAADIS, blood pressure and HbA1c were significantly decreased and HDL significantly increased but there were no statistically significant changes in LDL, T-CHOL, or TG. Also in both groups the BMI did not change significantly. In a comparison of clinical indicators between the groups, only HbA1c was significantly reduced in TAADIS compared to NDDP. The population reach increased in TAADIS from 1.6% in the year

2000 to 3.9% in 2002 and in NDDP from 4.2% to 8.5% over the same period. In summary, both groups had some positive changes in clinical indicators within the group but only HbA1c was significantly reduced in TAADIS when comparing the two groups.



## **1. INTRODUCTION:**

In the year 2001 in Australia almost one million people, or 7.6% of the adult population, aged 25 and above had diabetes (Australia's Health 2004). Based on data from AusDiab, it is estimated that about half these people were not aware that they had diabetes. In the Illawarra an estimated 13,571 (8.2%) of adults over 25 years have diabetes (Centre for General Practice Integration Studies, UNSW).

Some Divisions of General Practice attempt to improve the quality of chronic disease care in general practice by developing register systems which provide feedback on clinical activities and outcomes of patients treated by their GPs. This study has looked at the two data register systems currently used in Australia, **CARDIAB** and **TAADIS**.

**CARDIAB** is a database designed for use by Divisions of General Practice. It was developed in the late nineties by the CARDIAB Alliance which is a collaboration of Intouch Consultancy, Macarthur Division of General Practice, The Heart Foundation, the Centre for General Practice Integration Studies and the Pharmaceutical Alliance (TPA). CARDIAB focuses on cardiovascular and diabetes management within the primary health care system and enables collation of data on patients enrolled in the Division's programs. It provides a patient recall system, information on risk factor levels, management practices and profiles on high risk patients. CARDIAB is being used in over 40 Divisions of General Practice in Australia.

(<http://www.intouch.com.au/cardiab/default.htm>)

CARDIAB objectives are to:

- Provide a tool for medical practitioners and others to assist them to monitor the care of persons with diabetes and cardiovascular disease
- Support patient recall according to guidelines
- Contribute to quality improvements and service planning
- Collect data on patient outcomes
- Provide clinical reports in respect of practitioner performance.

**TAADIS** is database designed developed and operated by the Illawarra Division of General Practice which attempts to improve diabetes management by:

- Expanding access to diabetes patient's information to a broad range of health providers and patients themselves
- Educating GPs in the best management of diabetes

- Encouraging patient adherence to clinical management guidelines
  - Providing feedback on diabetes management to GPs
  - Using intelligent information methods to identify patients at risk of diabetes complications
  - Informing patients about how to manage their diabetes
- ( [www.idgp.org.au](http://www.idgp.org.au) )

Both systems offer the flexibility of data aggregation and statistical analyses. Clinical management data can be imported directly from pathology companies and from GP desktop software.

The NDDP has aggregated data from its CARDIAB programme for the years 2000-2002 and this data is compared with that obtained by the TAADIS system at the Illawarra Division of General Practice. As part of a stream of work on diabetes care in primary health being undertaken within the Centres for Primary Health Care and Equity, de-identified data from these two collections were compared to see if the two systems are able to achieve similar outcomes for patients.

## **2. AIMS**

The aim of this study was to compare the available de-identified diabetes data from TAADIS (Illawarra) and NDDP (National), which were collected during 2000-2002 and identify the changes in the clinical indicators that were collected for both study groups. This period of time (years 2000 to 2002) was chosen, as comparative data was available for both groups.

Further, this study aimed to find out if there was a significant difference in the monitoring and management of diabetes patients and also improvements in quality of care and outcomes over time between the two groups and to use the results as a tool to improve diabetes management.

## **3. METHODOLOGY**

### **3.1 Ethics approval**

This is a secondary analysis of data collected for two separate evaluations. Full ethics committee clearance and consent was initially obtained for both studies from the UNSW Human Research Ethics Committee and the Illawarra Area Health Service/University of Wollongong Human Research Ethics Committee. Further ethics approval was also obtained from UNSW to conduct this secondary analysis.

### **3.2 Obtaining data**

The de-identified data used in both studies was obtained from NDDP and TAADIS. The following Table shows the available data fields in both groups.

### **3.3 Data quality**

The NDDP data cleaning process was originally conducted by the Bankstown Diabetes Centre. The initial TAADIS data cleaning process was conducted by the IT team at the IDGP. These processes identified all missing data fields along with potentially invalid data values.

Although data in both centres had gone through a cleaning process, there was a need for second cleaning round. This process identified all missing data fields along with potentially invalid data values, like diastolic blood pressure of 190 or systolic blood pressure of 10 or 1139. Additionally, Lipids and HbA1c in TAADIS were all standardised in the previous assessment but for this study the original blood test results were used.

**Table 1: Comparison of available data fields in NDDP and TAADIS**

	<b>NDDP</b>	<b>TAADIS</b>
Date of birth	Y	Y
Gender	Y	Y
Date of last patient visit to GP	Y	Y
Diabetes type, duration, and treatment	Y	Only at enrolment, not monitored
Tobacco smoking status, consumption	Y	
Weight, Height, Body Mass Index	Y	Y
Systolic & Diastolic Blood Pressure	Y	Y
Medication	Y	
Foot examination	Y	
Medical history: MI, CVA. Asthma, etc	Y	
Lipids: Total cholesterol , LDL, HDL, TG	Y	Y
	<b>NDDP</b>	<b>TAADIS</b>
HbA1c measurement	Y	Y
Micro albumin measurement	Y	
Physical activity status	Y	
Alcohol consumption	Y	
<b>“Demographic characteristics of GPs: users and non-users”</b>	<b>Y</b>	<b>Y</b>
Number of GPs	Y	Y
Gender	Y	Y
Age groups	Y	Y
Practice size groups	Y	Y
Work patterns (full time or part time)	Y	Y
Accreditation	Y	Y

### 3.4 Statistical methods

Data were analysed using SPSS and the JMP statistical package. The results are shown as Mean  $\pm$  SE. In the first step data was checked for normal distribution. For analyzing the data within each group t-test and Chi-square statistical measurement were used. Also ANOVA was used to look at the correlations in the groups. To compare the data in two centres, MANOVA was used.

### 3.5 Quality of care and health outcome indicator targets

Table 2 shows the target for health outcome indicators that NDDP used (Nov 2004) in conjunction with: a) Royal Australian College of General Practitioners guidelines “Diabetes in General Practice”, b) NHMRC Evidence based guidelines, c). National

Heart Foundation guidelines, and d). NSW Health Principles 1996. This study also followed the same guidelines as above.

**Table 2: Values of indicators chosen for data analysis**

<b>INDICATOR</b>	<b>NORMAL</b>	<b>ABNORMAL – 1</b>	<b>ABNORMAL – 2</b>
Body Mass Index	$\leq 25$	$> 25 < 30$	$\geq 30$
Blood Pressure	$< 85$ diastolic $< 130$ systolic	$\geq 85$ diastolic $\geq 130$ systolic	
Total cholesterol	$< 5$	$\geq 5$	
HDL	$\geq 1$	$< 1$	
LDL	$< 3$	$\geq 3$	
Triglycerides	$< 2$	$\geq 2$	
HbA1c HbA1c – High HbA1c	$\leq 1\%$ upper limit of normal	$> 1 \leq 2\%$ upper limit of normal	$> 2$ upper limit of normal

## **4. RESULTS:**

### **4.1 Number of participants**

The total number of patient participants in NDDP (16 divisions) and TAADIS (Illawarra division) has increased in both groups. In TAADIS the number of participants increased by 40% in 2001 and by 68% in the year 2002, and in NDDP from 27% to 73% respectively. When comparing the average number of participants per Division in NDDP with total participants in TAADIS in the year 2001, TAADIS had more participants (40% vs. 13%) but from 2001 to 2002 the average number of participants per Division in NDDP increased dramatically to 80%, compared to 20% in TAADIS. The overall increase in numbers of patients on registers from 2000-2002 was 73% in NDDP, 104% in NDDP (Average per Division) and 68% in TAADIS. (Table3)

**Table 3: Total number of active patients in NDDP and TAADIS**

	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2000-2001</b>	<b>2001-2002</b>	<b>2000-2002</b>
<b>NDDP</b>	7,714	9,829	13,325	↑ 27%	↑ 36%	↑73%
<b>NDDP Average</b>	358	405	730	↑ 13%	↑ 80%	↑104%
<b>TAADIS</b>	313	438	527	↑ 40%	↑ 20%	↑68%

The number of blood tests and assessments conducted varied in each group and for each patient. In TAADIS each patient had from 1 to 10 tests for Lipids, BP, BMI, and HbA1c in each year (2000-2002). Most patients had about 2 tests of each clinical indicator per year as is shown in Table 4. For BP, there were 23% who had more than 3 and up to 10 results per year for 3 years. Therefore in TAADIS, if a patient had more than one result for any clinical indicator, the Mean was calculated and used for that year. For example if a patient had 4 HDL results in the year 2000, then the Mean of the 4 results was calculated and used. This multiplication result of clinical indicators was not observed in the NDDP. This could be due to the data cleaning and preparation process that was conducted originally.

**Table 4: The percentage of tests conducted per year (in 3 years) in TAADIS**

TAADIS	1 Test / yr	1.1-2.0 Tests / yr	2.1-3.0 Tests / yr	>3.1 Tests / yr
<b>HDL</b>	31%	<b>56%</b>	10%	3%
<b>LDL</b>	25%	<b>68%</b>	7%	0
<b>T-CHOL</b>	31%	<b>57%</b>	9%	3%
<b>TG</b>	31%	<b>69%</b>	0	0
<b>HbA1c</b>	33%	<b>67%</b>	0	0
<b>BP</b>	23%	<b>35%</b>	13%	23%
<b>BMI</b>	19%	<b>41%</b>	39%	1%

For the purpose of analyzing and comparing the results in both groups, the Mean of each clinical indicator was calculated. For both groups, although the number of participants increased, the number of clinical tests did not increase accordingly (Table 5).

**Table 5: Total number and percentage of tests conducted in NDDP and TAADIS**

	<b>HDL</b>		<b>LDL</b>		<b>T-CHOL</b>		<b>TG</b>	
<b>TAADIS</b>	n	%	n	%	n	%	n	%
<b>2000</b>	271	<b>87</b>	257	<b>82</b>	286	<b>91</b>	312	<b>100</b>
<b>2001</b>	346	<b>79</b>	334	<b>76</b>	328	<b>75</b>	364	<b>83</b>
<b>2002</b>	411	<b>78</b>	408	<b>77</b>	327	<b>62</b>	415	<b>79</b>
<b>NDDP</b>	n	%	n	%	n	%	n	%
<b>2000</b>	3331	<b>43</b>	3115	<b>40</b>	4376	<b>57</b>	4588	<b>60</b>
<b>2001</b>	4138	<b>42</b>	3872	<b>39</b>	5590	<b>57</b>	5383	<b>55</b>
<b>2002</b>	4690	<b>35</b>	4424	<b>33</b>	6285	<b>47</b>	6106	<b>46</b>
	<b>HbA1c</b>		<b>SBP</b>		<b>DBP</b>		<b>BMI</b>	
<b>TAADIS</b>	n	%	n	%	n	%	n	%
<b>2000</b>	249	<b>80</b>	231	<b>74</b>	231	<b>74</b>	159	<b>51</b>
<b>2001</b>	370	<b>84</b>	363	<b>83</b>	363	<b>83</b>	267	<b>61</b>
<b>2002</b>	438	<b>83</b>	459	<b>87</b>	459	<b>87</b>	259	<b>49</b>
<b>NDDP</b>	n	%	n	%	n	%	n	%
<b>2000</b>	4884	<b>63</b>	6002	<b>78</b>	6002	<b>78</b>	4549	<b>59</b>
<b>2001</b>	5814	<b>59</b>	6698	<b>68</b>	6698	<b>68</b>	5200	<b>53</b>
<b>2002</b>	6715	<b>50</b>	8023	<b>60</b>	8023	<b>60</b>	6723	<b>51</b>

#### 4.2 Population reach of Division registers

The population reach of Division registers was calculated using the Australian Bureau of Statistics (ABS) Basic Community Profiles for postal areas, 2001 Census. Diabetes prevalence estimates were based on the Australian Diabetes, Obesity and Lifestyle Report 2000 (AusDiab study) and adjusted for age. Diabetes prevalence for NDDP divisions varied from 3,634 to 14,389 with the Median of 8,625 and for Illawarra (TAADIS) it was 13,571 - age adjusted. The population reach in TAADIS was 1.6% in 2000, 2.6% in 2001 and 3.9% in 2002. The Median population reach across participating Divisions in NDDP was 4.2% in 2000, 4.7% in 2001 and 8.5% in 2002. (Table 6)

**Table 6: Population reach of Division diabetes program, 2000-2002**

	<b>Diabetes prevalence</b>	<b>2000</b>	<b>%</b>	<b>2001</b>	<b>%</b>	<b>2002</b>	<b>%</b>
<i>NDDP (Median)</i>	8,625 (3,634 - 14,389)	358	4.2	405	4.7	730	8.5
Illawarra TAADIS	13,571	211	1.6	356	2.6	527	3.9

#### 4.3 Characteristics of GP program users / non-users

The GP characteristics of those using / not-using CARDIAB or TAADIS are shown in Table 7. Around 2/3 of GPs were male in both groups but the percentage of female GPs who used TAADIS (33%) was more than GPs of NDDP users (29%) and GPs of non users (31%). More than 75% of them were accredited practices in both groups. In TAADIS 67% of GPs were working in a practice of 2 to 5 GPs, compared to 40% in NDDP respectively. This was statistically significant in all groups of program users and non users. Also 83% of GPs in TAADIS worked full time compared to 87% of GPs in NDDP. In regard to age group, 37% of GPs who used TAADIS and 57% of GPs who used NDDP were in 45-54 age categories. Also 33% of GPs who used TAADIS and 17% of GPs who used NDDP were in 35-44 age categories. These two age categories were significantly different which means that the GPs who used TAADIS were younger than the GPs who used NDDP.

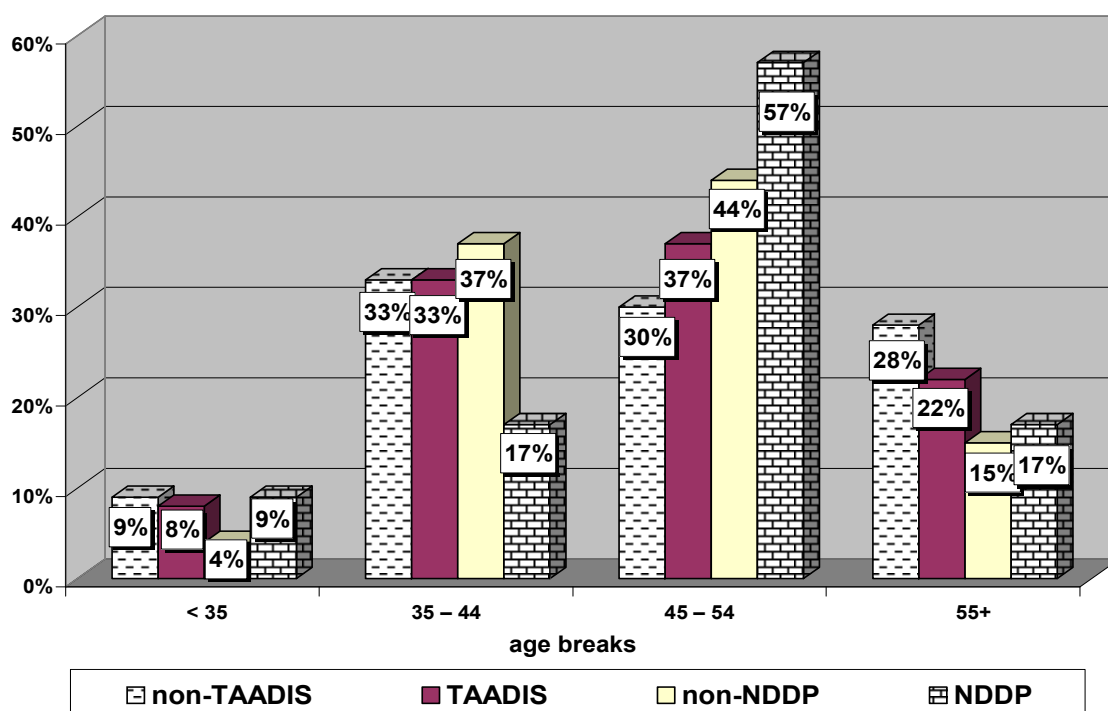


**Table 7: Percentage of GP users / not-users in TAADIS & NDDP**

	TAADIS (Illawarra Division)		NDDP (National Divisions)	
	GP Users	GP Non-users	GP Users	GP Non-users
<b>Gender</b>				
Female GP	33%	27%	29%	31%
Male GP	67%	73%	71%	69%
<b>Accredited</b>	78%	53%	76%	62%
<b>Practice type</b>				
Solo	14%	25%	20%	20%
Practice 2-5	<b>67%</b>	42%	40%	41%
Practice 5+	19%	33%	40%	39%
<b>Work type</b>				
Full time	83%	73%	87%	74%
Part time	17%	27%	13%	26%
<b>Age groups</b>				
< 35	8%	9%	9%	4%
35 – 44	<b>33%</b>	33%	<b>17%</b>	37%
45 – 54	<b>37%</b>	30%	<b>57%</b>	44%
55+	22%	28%	17%	15%

In summary, although there were more male GPs who used both programs, the percentage of females was higher in TAADIS and GPs who used TAADIS were younger compared to GPs who used the NDDP.

**Figure 1: Comparison of GPs age break in Illawarra (TAADIS & non-TAADIS users) and National wide (NDDP & non-NDDP users)**



#### 4.4 Analysis of cohort data in 2000-2002

The average number of patients per division in the NDDP cohort was **188** (total number of patients for 16 divisions = 3002) and **248** in TAADIS. Patients analysed in the cohort had to have seen a GP at least once in each of the three years 2000, 2001 and 2002. The number of tests in clinical indicators varied in each group. In general the TAADIS groups had more Lipid and HbA1c blood test results but NDDP had more results for BP and BMI (Table 8).

**Table 8: Number and percentage of tests conducted in cohort study (2000-2002)**

	<b>HDL</b>		<b>LDL</b>		<b>T-CHOL</b>		<b>TG</b>	
	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>
<b>TAADIS</b>	174	<b>70</b>	158	<b>64</b>	191	<b>77</b>	191	<b>77</b>
<b>NDDP</b>	699	<b>23</b>	629	<b>21</b>	1330	<b>44</b>	1220	<b>41</b>
	<b>HbA1c</b>		<b>SBP</b>		<b>DBP</b>		<b>BMI</b>	
<b>TAADIS</b>	194	<b>78</b>	151	<b>61</b>	151	<b>61</b>	123	<b>50</b>
<b>NDDP</b>	2038	<b>68</b>	2305	<b>77</b>	2305	<b>77</b>	1806	<b>60</b>

#### 4.5 Quality of care

To compare the quality of care being offered by GPs in both groups the clinical management guidelines as described earlier in this report were used. As the TAADIS group did not have any or enough data for eye care, foot care, and micro albumin, during 2000 – 2002, these clinical indicators were excluded. The clinical indicators used to describe the quality of care are presented as 2 models. Model 1 (7 indicators) includes Blood pressure, BMI, HbA1c, total cholesterol, TG, HDL, and LDL. Model 2, (4 indicators) which are the same indicators used in the NDDP Diabetes Quality of Care Report (Nov. 2003), includes Blood pressure, BMI, HbA1c, and total cholesterol (excluding eye care, foot care, and micro albumin).

**Model 1:** The percentage of patients who had all 7 assessments conducted in each year dropped in both groups. The TAADIS group had a higher percentage of patients (38%) with all assessments done in the year 2001 compared to the NDDP group (21%). But the percentage declined to 32% in 2001 and 24% in 2002 respectively. In NDDP the percentage dropped to 19% in 2001 and remained the same in 2002. (Table 9)

**Table 9: Percent of patients using Model 1 assessment in TAADIS & NDDP group**

<b>Year</b>	<b>TAADIS</b>	<b>NDDP</b>
<b>2000</b>	38%	21%
<b>2001</b>	32%	19%
<b>2002</b>	24%	19%

**Model 2** The percentage of patients who had all 4 assessments conducted in each year dropped in both groups in 2001, dropped further in the NDDP group in 2002 but increased in the TAADIS group (Table 10).

**Table 10: Percent of patients using Model 2 assessment in TAADIS & NDDP group**

<b>Year</b>	<b>TAADIS</b>	<b>NDDP</b>
<b>2000</b>	39%	32%
<b>2001</b>	33%	29%
<b>2002</b>	36%	28%

#### **4.6 Health outcome indicators**

##### **Blood pressure**

##### **a) Within the groups:**

##### **TAADIS**

The Mean ( $\pm$  SE) systolic blood pressure (SBP) changed from  $140 \pm 1.0$  in the year 2000 to  $136 \pm 0.4$  in 2001 and  $134 \pm 0.9$  in 2002. The mean diastolic blood pressure (DBP) changed from  $80 \pm 0.6$  in the year 2000 to  $78 \pm 0.6$  in 2001 and  $77 \pm 0.5$  in 2002.

When comparing changes **within** the group in TAADIS (repeated measurement), there was a significant difference between *2000 and 2001* data in SBP ( $P = 0.0047$ ) and DBP ( $P = 0.0269$ ). Also in comparing *2000 and 2002* data, there were significant differences in SBP ( $P = <0.0001$ ) and DBP ( $P = 0.001$ ). But changes between 2001 and 2002 were not significant in SBP ( $p = 0.0725$ ) or DBP ( $P = 0.5223$ ).

##### **NDDP**

The Mean SBP changed from  $138 \pm 0.4$  in the year 2000 to  $137 \pm 0.4$  in 2001 and  $136 \pm 0.3$  in 2002. The mean diastolic blood pressure (DBP) changed from  $79 \pm 0.2$  in the year 2000 to  $78 \pm 0.2$  in 2001 and  $78 \pm 0.2$  in 2002.

When comparing changes **within** the group in NDDP, there were significant differences between *2000 and 2001* data in SBP ( $P = 0.0445$ ) and DBP ( $P = <0.0001$ ). Also in comparing 2000 and 2002 data there were significant differences in SBP ( $P = 0.0002$ )

and DBP ( $P = <0.001$ ). But changes between 2001 and 2002 were not significant in SBP ( $P = 0.3414$ ) or DBP ( $P = 0.1881$ ). (Fig.2)

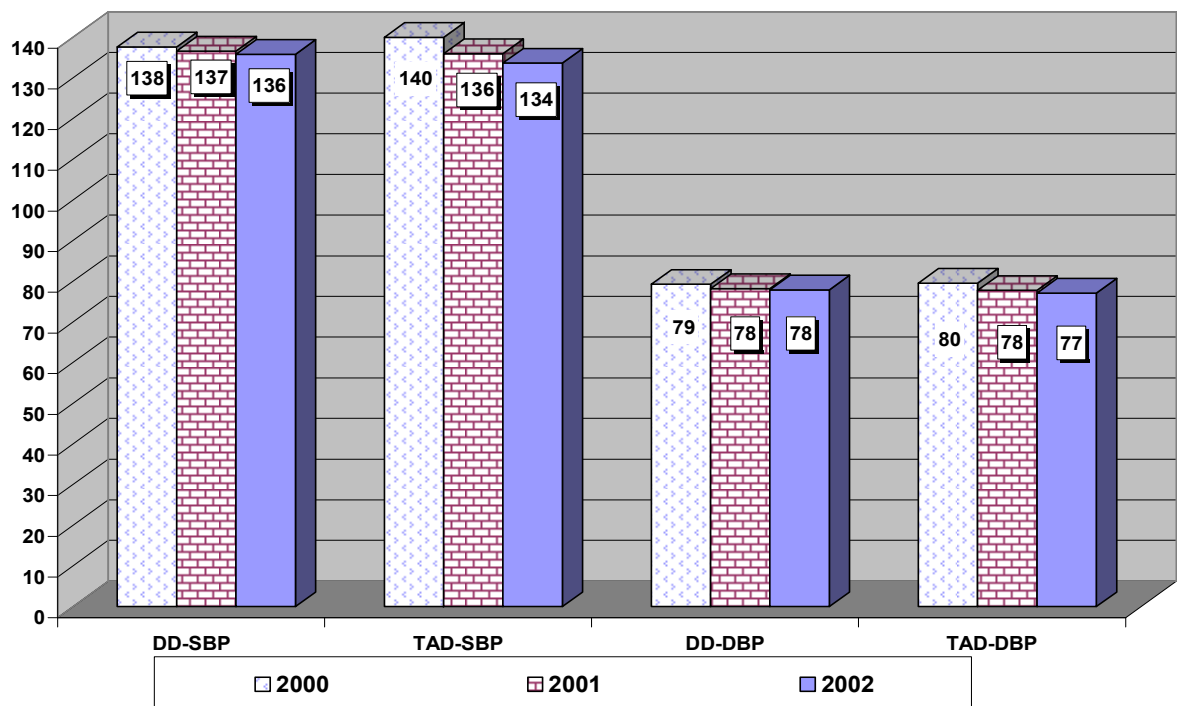
**b) Between the groups:**

To compare changes **between** the groups (TAADIS & NDDP) Multi Analysis Of Variance (MANOVA) was used. The results did not show statistically significant differences between the two groups in SBP ( $F = 0.890$ ) or in DBP ( $F = 0.610$ ).

**c) Comparison of changes:**

When looking at the changes in SBP during 2000 -2001 and comparing the differences that occurred in both groups, the changes in TAADIS were more significant ( $P = 0.0405^*$ ). During 2001-2002, the changes were not significant but during 2000-2002 the changes was statistically significant ( $P = 0.0030^*$ ) (Table 11).

**Figure 2: Comparisons of SBP & DBP in TAADIS and NDDP during 2000 – 2002**



**Table 11: Comparison of changes in the two groups during 2000 – 2002**

	2000-2001		Prob>F	2001-2002		Prob>F	2000-2002		Prob>F
	TAADIS	NDDP		TAADIS	NDDP		TAADIS	NDDP	
<b>SBP</b>	-4.0	-1.0	<b>0.0405*</b>	-2.4	-0.8	0.2610	-6.3	-1.8	<b>0.0030*</b>
$\pm$ SE	0.9	0.4		0.9	0.4		1.01	0.4	
<b>DBP</b>	-1.8	-1.0	0.1831	-0.7	-0.4	0.5059	-2.5	-1.4	0.0804
$\pm$ SE	0.5	0.2		0.5	0.2		0.6	0.2	

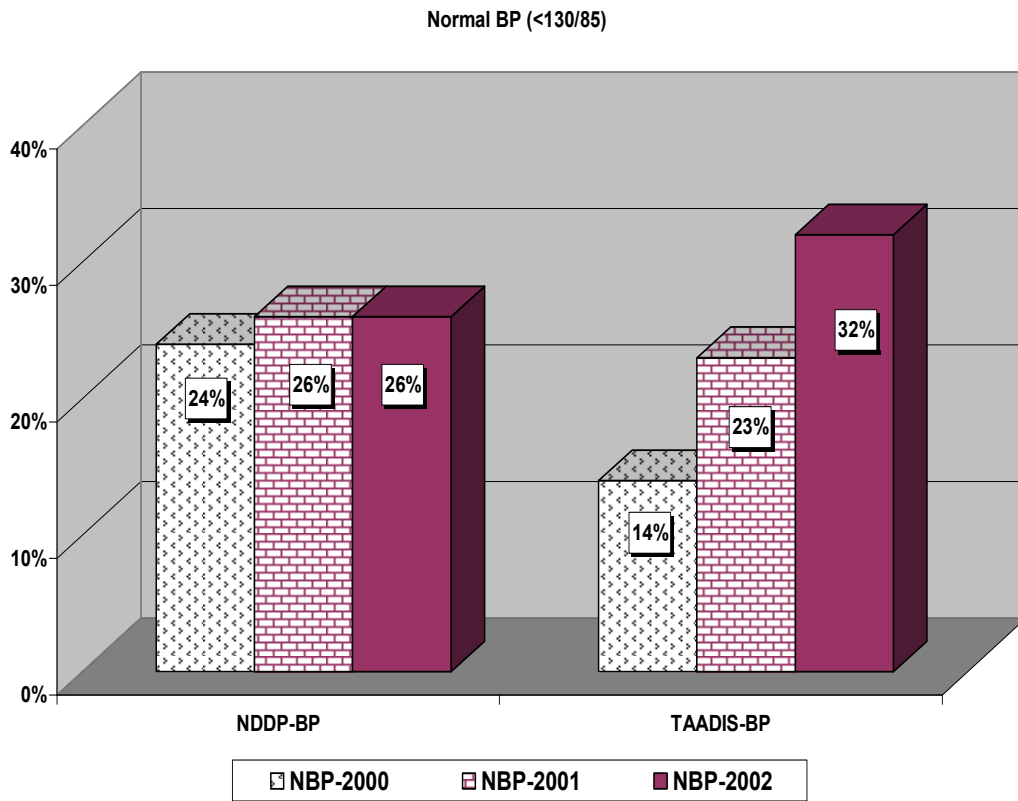
**d) Normal Blood Pressure:**

Calculation of the percentage of those within normal range of blood pressure (BP < 130/85 mmHg) shows that, in the year 2000, there were 14% of participants in TAADIS with BP in normal range compared to 24% of participants in NDDP. During the years 2000 - 2002, the number of participants with BP in normal range increased significantly from 14% to 32% in TAADIS, compared to from 24% to 26% in the NDDP group. (Figure 3)

**Comments:**

The TAADIS group had initially higher blood pressure, compared to the NDDP group and a lower percentage of patients with normal blood pressure. During 2000-2002, blood pressure (systolic and diastolic) reduced significantly in both groups and consequently the percentage of patients with normal BP has increased. But the changes in the TAADIS group were statistically more significant, especially in SBP.

**Figure 3: Comparison of number of participants within normal range of BP in TAADIS & NDDP**



## **High Density Lipoprotein (HDL)**

### **a) Within the groups:**

#### **TAADIS**

The Mean ( $\pm$  SE) HDL increased from  $1.18 \pm 0.02$  in the year 2000 to  $1.28 \pm 0.02$  in 2001 and  $1.27 \pm 0.02$  in 2002.

When comparing changes **within** the group in TAADIS, there was a significant increase in HDL from *2000 to 2001* ( $P = 0.0047^*$ ). Also in comparing *2000 and 2002* data, there was a significant increase in HDL ( $P = 0.0061^*$ ). But changes between 2001 and 2002 were not significant ( $P = 0.0725$ ).

#### **NDDP**

The Mean ( $\pm$  SE) HDL increased from  $1.22 \pm 0.01$  in the year 2000 to  $1.23 \pm 0.01$  in 2001 and  $1.25 \pm 0.01$  in 2002.

When comparing changes **within** the group in NDDP, there were no significant changes in HDL from *2000 to 2001* ( $P = 0.6654$ ), or from *2000 to 2002* ( $P = 0.3661$ ) or from *2001 to 2002* ( $P = 0.1769$ ). (Fig. 4)

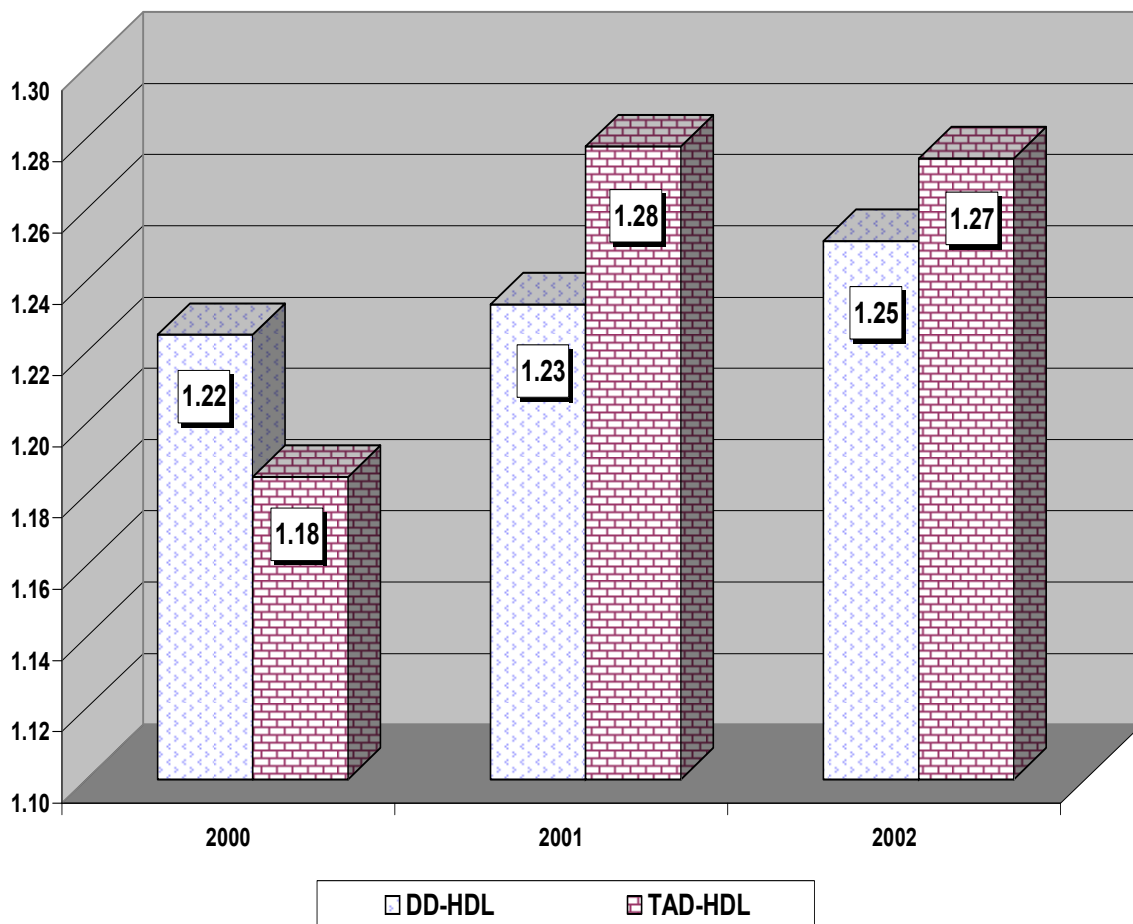
### **b) Between the groups:**

To compare changes **between** the groups (TAADIS & NDDP) Multi Analysis Of Variance (MANOVA) was used. The results did not show statistically significant differences between the two groups in HDL ( $F = 0.740$ ).

### **c) Comparison of changes in HDL:**

When looking at the changes in HDL during 2000 -2001 and comparing the differences that occurred in both groups, the changes in TAADIS were more significant ( $P < 0.0001^*$ ). During 2001-2002, the changes were not significant ( $P = 0.2754$ ) but during 2000-2002 the changes were statistically significant ( $P = 0.0035^*$ ) (Table 12).

**Figure 4: Comparison of HDL in TAADIS and NDDP during 2000 – 2002**



**Table 12: Comparison of changes in the two groups in HDL during 2000 – 2002**

	2000-2001		Prob>F	2001-2002		Prob>F	2000-2002		Prob>F
	TAADIS	NDDP		TAADIS	NDDP		TAADIS	NDDP	
<b>HDL</b>	0.093	0.008	<b>&lt;0.0001*</b>	-0.003	0.018	0.2754	0.089	0.026	<b>0.0035*</b>
<b>± SE</b>	0.01	0.009		0.01	0.01		0.015	0.010	

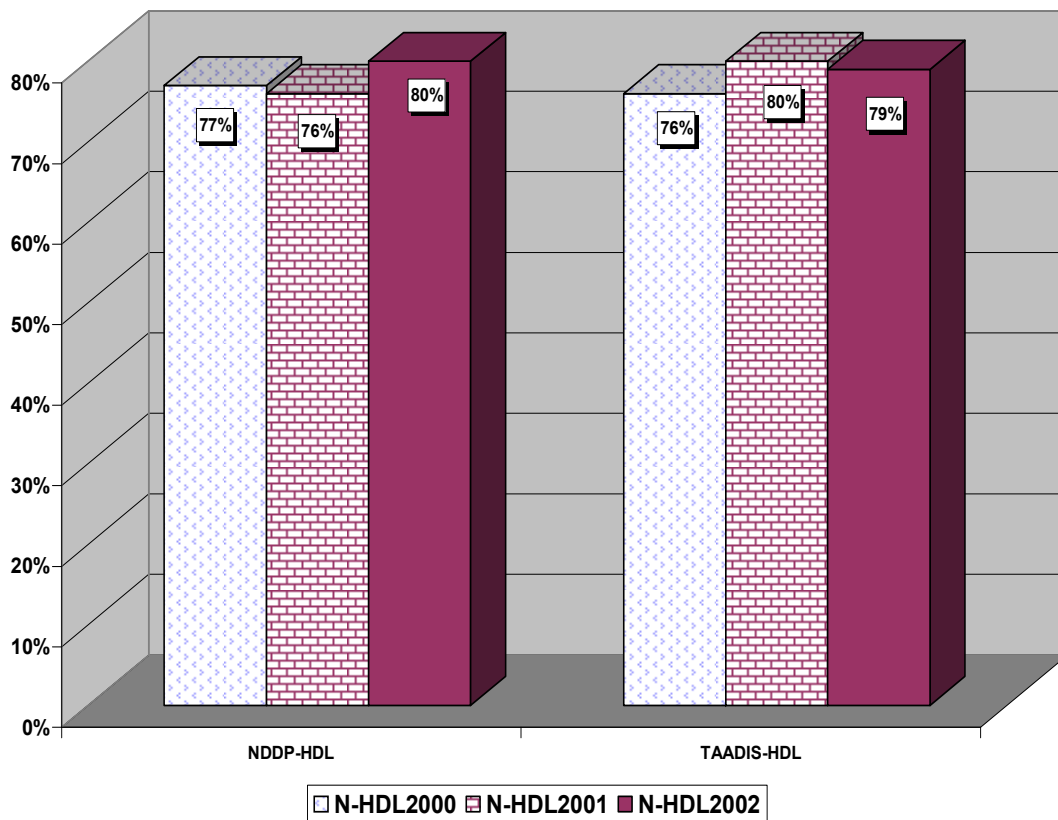
**d) Normal HDL:**

Calculation of the percentage of those within normal range of HDL (HDL  $\geq$  1.0 mmol/L) shows that, in the year 2000, there were 76% of participants in TAADIS with HDL in normal range compared to 77% of participants in NDDP. In TAADIS, the number of participants with HDL in normal range increased from 76% in 2000 to 80%



in 2001 and 79% in 2002. In NDDP, HDL decreased from 77% in 2000 to 76% in 2001 and increased to 80% in 2002. (Figure 5)

**Figure 5: Comparison of number of participants within normal range of HDL in TAADIS & NDDP**



**Comments:**

During 2000-2002, HDL increased significantly within TAADIS but not between the two groups (TAADIS & NDDP). In NDDP, although the HDL increased during 2000 – 2002 the changes were not statistically significant.

## **Low Density Lipoprotein (LDL)**

### **a) Within the groups:**

#### **TAADIS**

The Mean ( $\pm$  SE) LDL decreased from  $2.88 \pm 0.06$  in the year 2000 to  $2.72 \pm 0.07$  in 2001 and  $2.77 \pm 0.06$  in 2002.

When comparing changes **within** the group in TAADIS, there was a decrease in LDL from 2000 to 2001 ( $P = 0.0724$ ) but it was not statistically significant. In comparing 2000 and 2002 data, there was a decrease in LDL ( $P = 0.1892$ ). Also there were no significant changes between 2001 and 2002 ( $P = 0.6156$ ).

#### **NDDP**

The Mean ( $\pm$  SE) LDL decreased from  $3.0 \pm 0.04$  in the year 2000 to  $2.78 \pm 0.03$  in 2001 and  $2.67 \pm 0.03$  in 2002.

When comparing changes **within** the group in NDDP, there was a significant changes in LDL from 2000 to 2001 ( $P < 0.0001^*$ ), and from 2000 to 2002 ( $P < 0.0001^*$ ) and from 2001 to 2002 ( $P = 0.01708^*$ ). (Fig. 6)

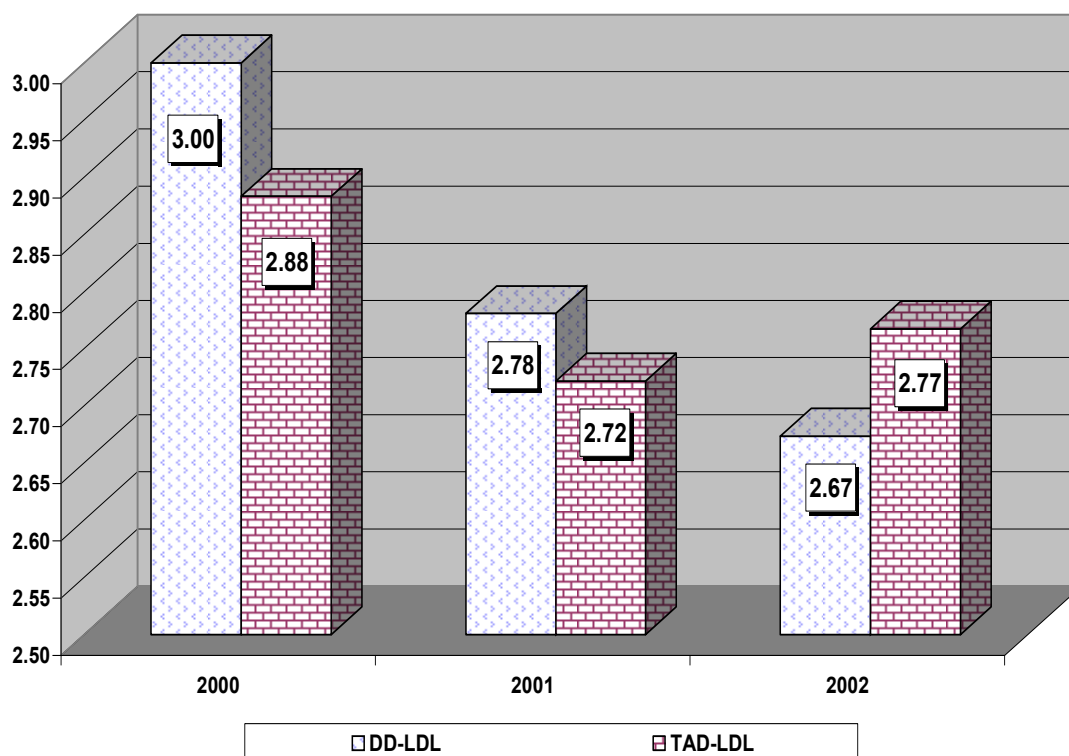
### **b) Between the groups:**

To compare changes **between** the groups (TAADIS & NDDP) Multi Analysis Of Variance (MANOVA) was used. The results did not show statistically significant differences between the groups in LDL ( $F = 0.665$ ).

### **c) Comparison of changes in LDL:**

When looking at the changes in LDL during 2000 -2001 and comparing the differences that occurred in both groups, the changes in TAADIS were more significant ( $P < 0.0001^*$ ). During 2001-2002, the changes were not significant ( $P = 0.2754$ ) but during 2000-2002 the changes were statistically significant ( $P = 0.0035^*$ ) (Table 13).

**Figure 6: Comparison of LDL in TAADIS and NDDP during 2000 – 2002**



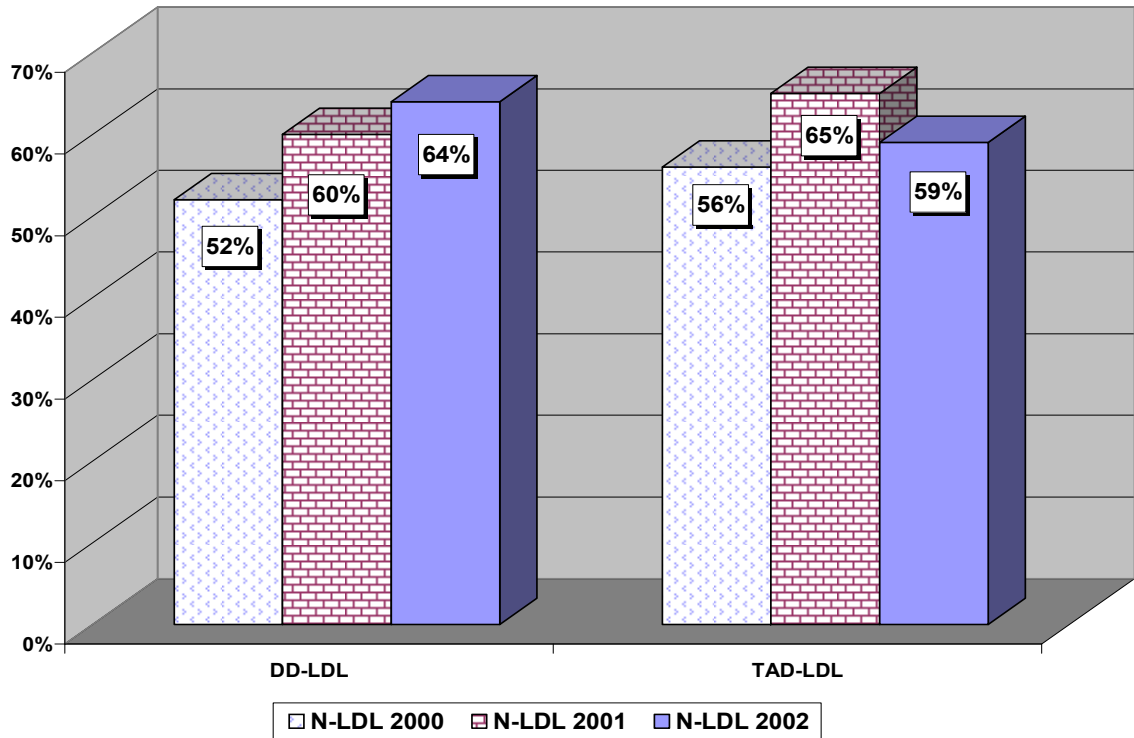
**Table 13: Comparison of changes in the two groups in LDL during 2000 – 2002**

	2000-2001		Prob>F	2001-2002		Prob>F	2000-2002		Prob>F
	TAADIS	NDDP		TAADIS	NDDP		TAADIS	NDDP	
<b>LDL</b>	-0.161	0.217	0.4276	0.0457	-0.107	<b>0.0113*</b>	-0.116	-0.324	<b>0.0068*</b>
$\pm$ SE	0.06	0.03		0.05	0.03		0.06	0.04	

**d) Normal LDL:**

Calculation of the percentage of those within normal range of LDL (LDL < 3.0 mmol/L) shows that, in the year 2000, there were 56% of participants in TAADIS with LDL in normal range compared to 52% of participants in NDDP. In TAADIS, the number of participants with LDL in normal range increased from 56% in 2000 to 65% in 2001 and 59% in 2002. In NDDP, it increased from 52% in 2000 to 60% in 2001 and 64% in 2002. (Figure 7)

**Figure 7: Comparison of number of participants within normal range of LDL in TAADIS & NDDP**



**Comments:**

During 2000-2002, LDL decreased significantly in NDDP, within the group but not between the groups (TAADIS & NDDP). In TAADIS, although the LDL decreased during 2000 – 2002 the changes were not statistically significant.

## **Total Cholesterol (T-Chol)**

### **a) Within the groups:**

#### **TAADIS**

The Mean ( $\pm$  SE) T-CHOL decreased from  $5.03 \pm 0.06$  in the year 2000 to  $4.94 \pm 0.07$  in 2001 and stayed the same in 2002 ( $4.94 \pm 0.07$ ).

When comparing changes **within** the group in TAADIS, there was a decrease in T-CHOL from *2000 to 2001* ( $P = 0.3089$ ) which was not statistically significant. In comparing *2000 and 2002* data, there was a decrease in T-CHOL ( $P = 0.3367$ ). Also there were no significant changes between 2001 and 2002 ( $P = 0.9500$ ).

#### **NDDP**

The Mean ( $\pm$  SE) T-CHOL decreased from  $5.14 \pm 0.03$  in the year 2000 to  $4.88 \pm 0.02$  in 2001 and  $4.80 \pm 0.03$  in 2002.

When comparing changes **within** the group in NDDP, there was a significant change in T-CHOL from *2000 to 2001* ( $P = < 0.0001^*$ ), and from *2000 to 2002* ( $P = < 0.0001^*$ ) and from *2001 to 2002* ( $P = 0.0270^*$ ). (Fig 8)

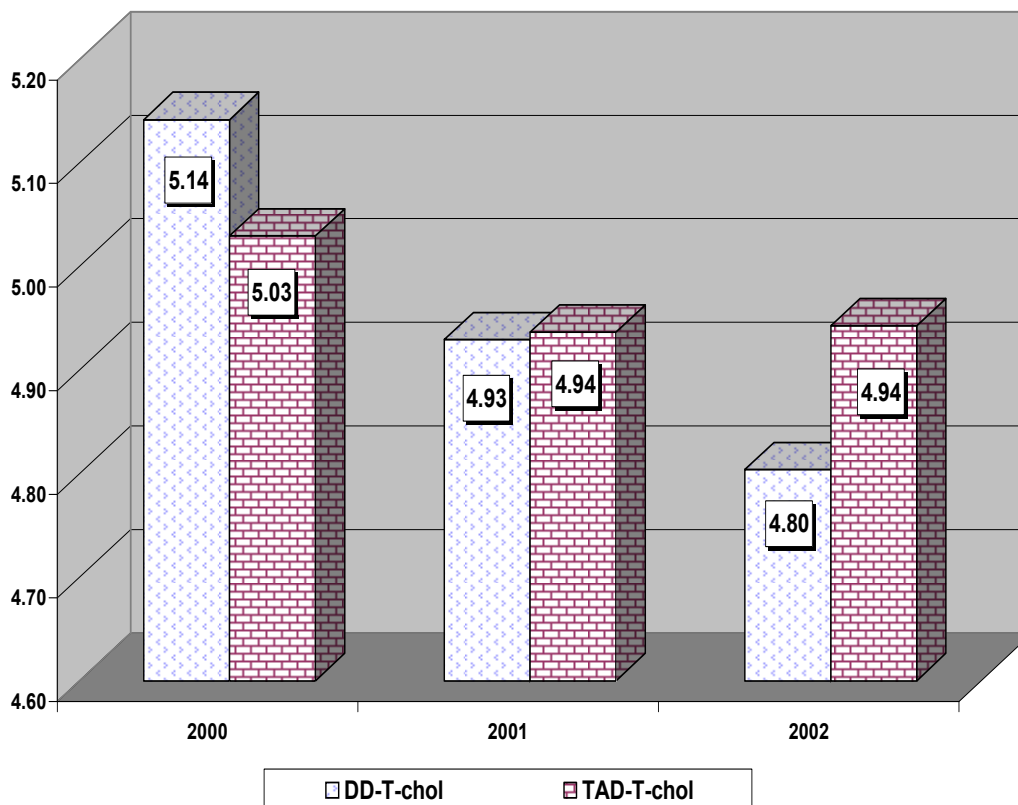
### **b) Between the groups:**

To compare changes **between** the groups (TAADIS & NDDP) Multi Analysis Of Variance (MANOVA) was used. The results did not show statistically significant differences between the two groups in T-CHOL ( $F = 0.855$ ).

### **c) Comparison of changes in T-CHOL:**

When looking at the changes in T-CHOL during 2000 - 2001 and comparing the differences that occurred in both groups, the changes in TAADIS were more significant ( $P = < 0.0001^*$ ). During 2001-2002, the changes were not significant ( $P = 0.2754$ ) but during 2000-2002 the changes were statistically significant ( $P = 0.0035^*$ ) (Table 14).

**Fig. 8: Comparison of T-CHOL in TAADIS and NDDP during 2000 – 2002**



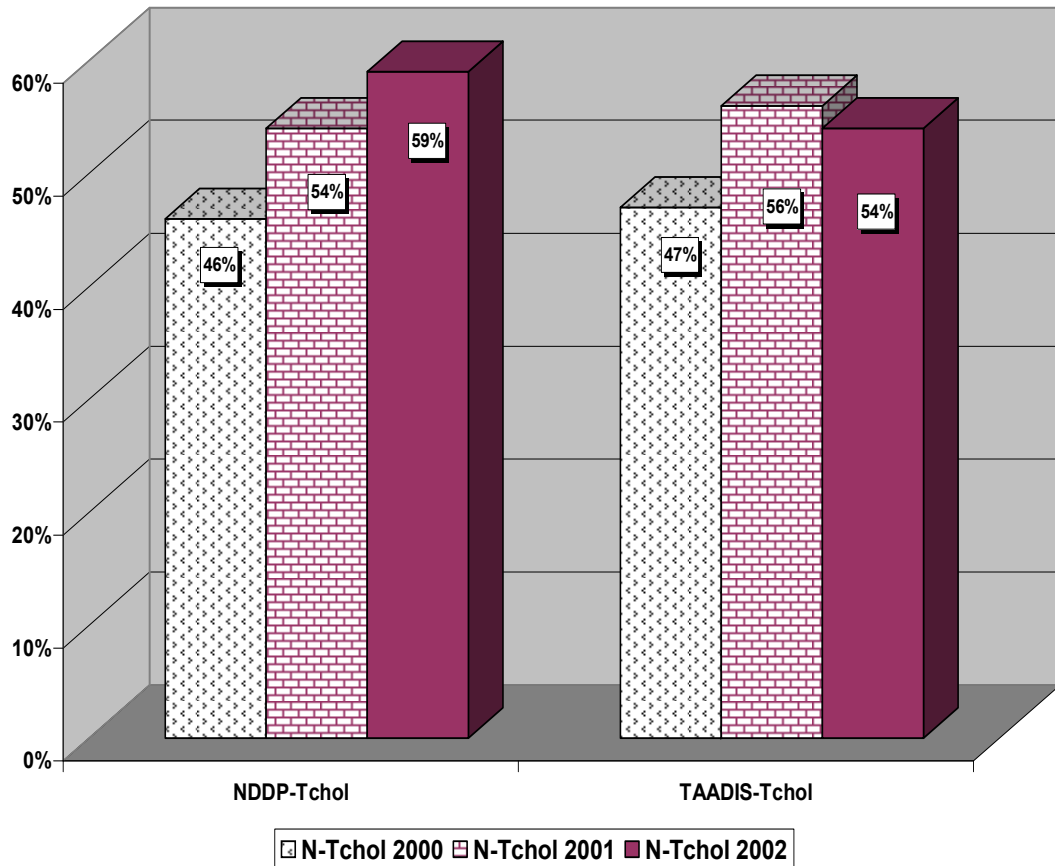
**Table 14: Comparison of changes in two groups in T-CHOL during 2000 – 2002**

	2000-2001		Prob>F	2001-2002		Prob>F	2000-2002		Prob>F
	TAADIS	NDDP		TAADIS	NDDP		TAADIS	NDDP	
<b>T-CHOL</b>	-0.161	0.217	0.4276	0.0457	-0.107	<b>0.0113*</b>	-0.116	-0.324	<b>0.0068*</b>
<b>± SE</b>	0.06	0.03		0.05	0.03		0.06	0.04	

**d) Normal T-CHOL:**

Calculation of the percentage of those within normal range of T-CHOL in (T-CHOL < 5.0 mmol/L) shows that, in the year 2000, there were 47% of participants in TAADIS with T-CHOL in normal range compared to 46% of participants in NDDP. In TAADIS, the number of participants with T-CHOL in normal range increased from 47% in 2000 to 56% in 2001 and 54% in 2002. In NDDP, it increased from 46% in 2000 to 54% in 2001 and 59% in 2002. (Figure 9)

**Figure 9: Comparison of number of participants within normal range of T-CHOL in TAADIS & NDDP**



**Comments:**

During 2000-2002, T-CHOL decreased significantly in NDDP, within the groups but not between the groups (TAADIS & NDDP). In TAADIS, although T-CHOL decreased during 2000 – 2002 the changes were not statistically significant.

## **Triglyceride (TG)**

### **a) Within the groups:**

#### **TAADIS**

The Mean ( $\pm$  SE) TG decreased from  $2.18 \pm 0.08$  in the year 2000 to  $2.06 \pm 0.08$  in 2001 and  $1.99 \pm 0.07$  in 2002.

When comparing changes **within** the group in TAADIS, there was a decrease in TG from 2000 to 2001 ( $P = 0.3089$ ) but it was not statistically significant. In comparing 2000 and 2002 data, there was a decrease in TG ( $P = 0.3367$ ). Also there were no significant changes between 2001 and 2002 ( $P = 0.9500$ ).

#### **NDDP**

The Mean ( $\pm$  SE) TG decreased from  $2.24 \pm 0.04$  in the year 2000 to  $2.08 \pm 0.04$  in 2001 and  $2.06 \pm 0.04$  in 2002.

When comparing changes **within** the group in NDDP, there were significant changes in TG from 2000 to 2001 ( $P = < 0.0001^*$ ), and from 2000 to 2002 ( $P = < 0.0001^*$ ) and from 2001 to 2002 ( $P = 0.0270^*$ ). (Fig. 10)

### **b) Between the groups:**

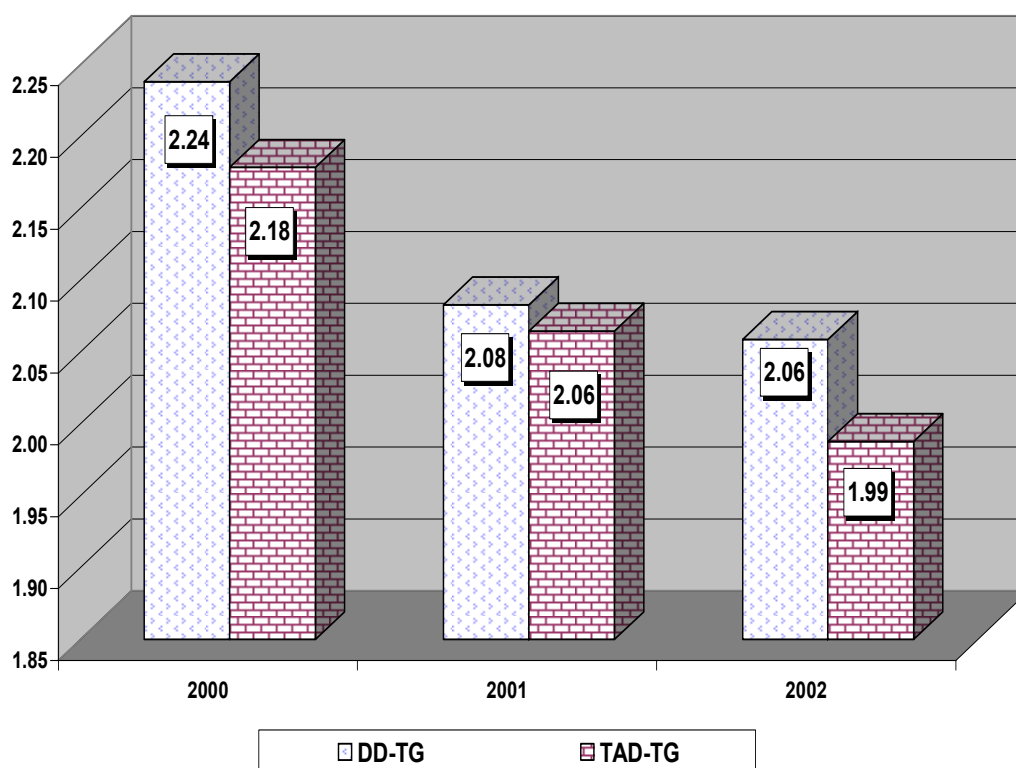
To compare changes **between** the groups (TAADIS & NDDP) Multi Analysis Of Variance (MANOVA) was used. The results did not show statistically significant differences between the two groups in TG ( $F = 0.575$ ).

### **c) Comparison of changes in TG:**

When looking at the changes in TG during 2000 -2001 and comparing the differences that occurred in both groups, the changes in TAADIS were more significant ( $P = < 0.0001^*$ ). During 2001-2002, the changes were not significant ( $P = 0.2754$ ) but during 2000-2002 the changes were statistically significant ( $P = 0.0035^*$ ) (Table 15).



**Figure 10: Comparison of TG in TAADIS and NDDP during 2000 – 2002**



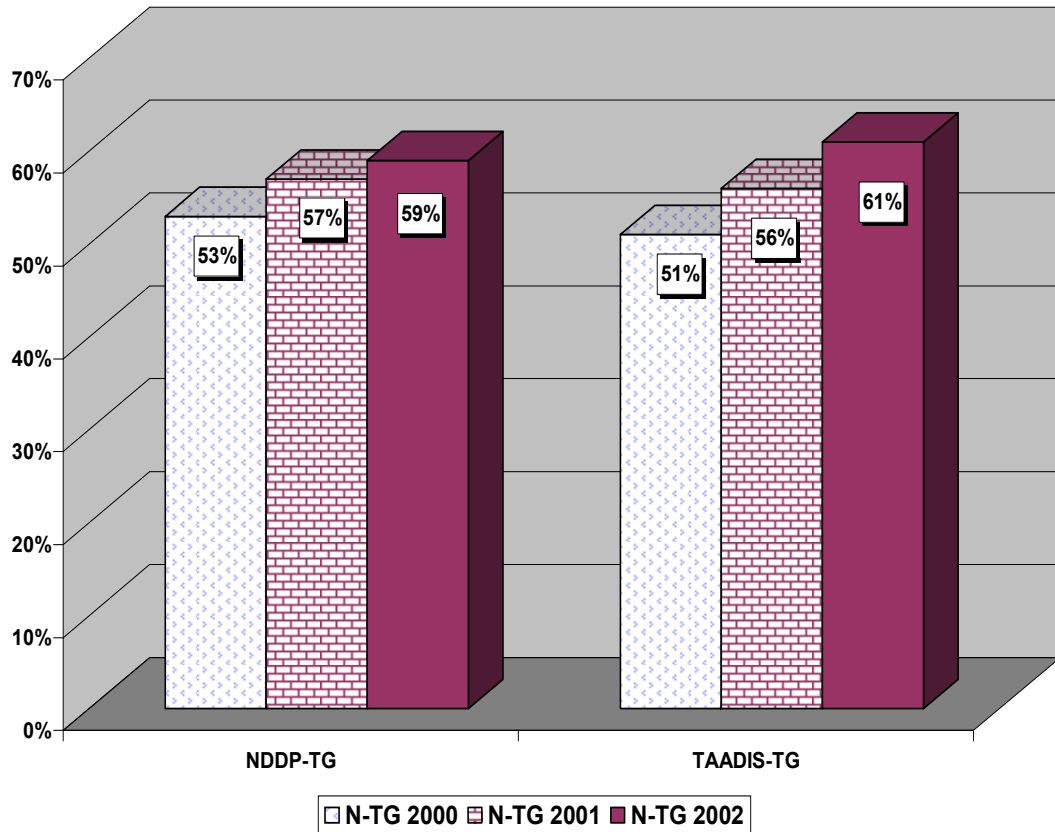
**Table 15: Comparison of changes in the two groups in TG during 2000 – 2002**

	2000-2001		Prob>F	2001-2002		Prob>F	2000-2002		Prob>F
	TAADIS	NDDP		TAADIS	NDDP		TAADIS	NDDP	
<b>TG</b>	-0.11	-0.16	0.5671	-0.08	-0.02	0.3376	-0.19	-0.18	0.8756
<b>± SE</b>	0.06	0.04		0.04	0.03		0.06	0.04	

**d) Normal TG:**

Calculation of the percentage of those within normal range of TG (TG < 2.0 mmol/L) shows that, in the year 2000, there were 51% of participants in TAADIS with TG in normal range compared to 53% of participants in NDDP. In TAADIS, the number of participants with TG in normal range increased from 51% in 2000 to 56% in 2001 and 61% in 2002. In NDDP, it increased from 53% in 2000 to 57% in 2001 and 59% in 2002. (Figure 11)

**Figure 11: Comparison of number of participants within normal range of TG in TAADIS & NDDP**



**Comments:**

During 2000-2002, TG decreased significantly in TAADIS, within the group but not between the groups (TAADIS & NDDP). In NDDP, although the TG decreased during 2000 – 2002 the changes were not statistically significant.

## **Glycated Haemoglobin (HbA1c)**

### **a) Within the groups:**

#### **TAADIS**

The Mean ( $\pm$  SE) HbA1c decreased from  $7.4 \pm 0.09$  in the year 2000 to  $7.1 \pm 0.08$  in 2001 and  $6.9 \pm 0.07$  in 2002.

When comparing changes **within** the group in TAADIS, there was a statistically significant decrease in HbA1c from *2000 to 2001* ( $P = 0.0410^*$ ). In comparing *2000 and 2002* data ( $P = 0.0001^*$ ), and also *2001 and 2002* data ( $P = 0.0471^*$ ), there was a statistically significant decrease in HbA1c.

#### **NDDP**

The Mean ( $\pm$  SE) HbA1c decreased from  $7.5 \pm 0.03$  in the year 2000 to  $7.3 \pm 0.03$  in 2001 and  $7.3 \pm 0.03$  in 2002.

When comparing changes **within** the group in NDDP, there was a significant change in HbA1c from *2000 to 2001* ( $P = < 0.0001^*$ ), and from *2000 to 2002* ( $P = < 0.0001^*$ ) and from *2001 to 2002* ( $P = 0.0270^*$ ). (Fig 12)

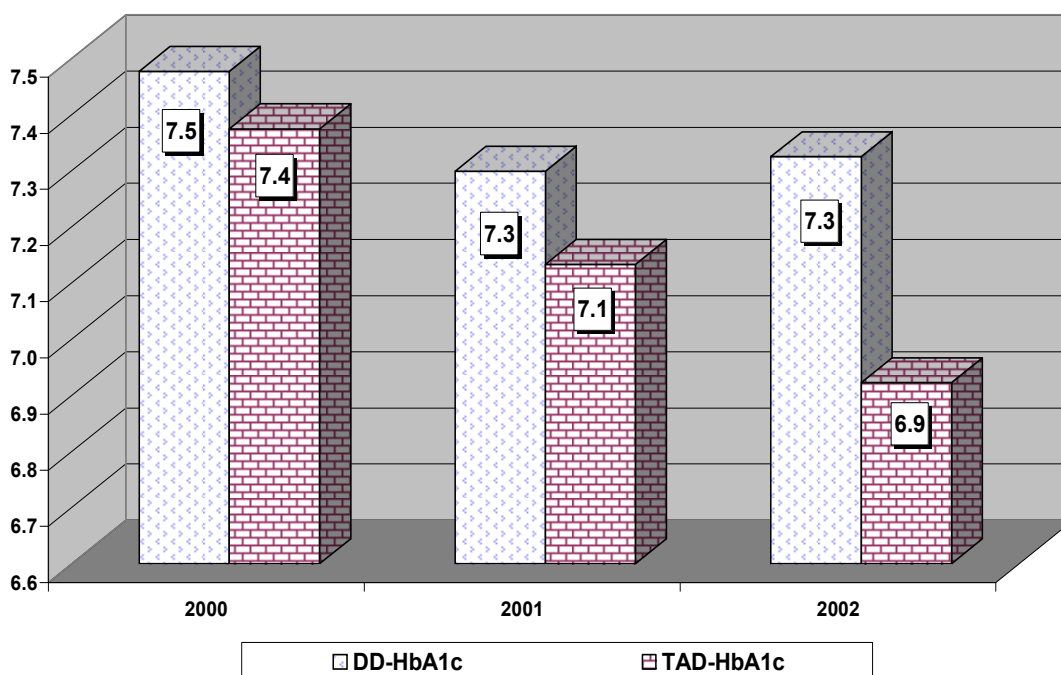
### **b) Between the groups:**

To compare changes **between** the groups (TAADIS & NDDP) Multi Analysis Of Variance (MANOVA) was used. The results showed statistically significant differences between the two groups in HbA1c ( $F = 0.012^*$ ).

### **c) Comparison of changes in HbA1c:**

When looking at the changes in HbA1c during 2000 - 2001 and comparing the differences that occurred in both groups, the changes in TAADIS were more significant ( $P = < 0.0001^*$ ). During 2001-2002, the changes were not significant ( $P = 0.2754$ ) but during 2000-2002 the changes were statistically significant ( $P = 0.0035^*$ ) (Table 16).

**Figure 12: Comparison of HbA1c in TAADIS and NDDP during 2000 – 2002**



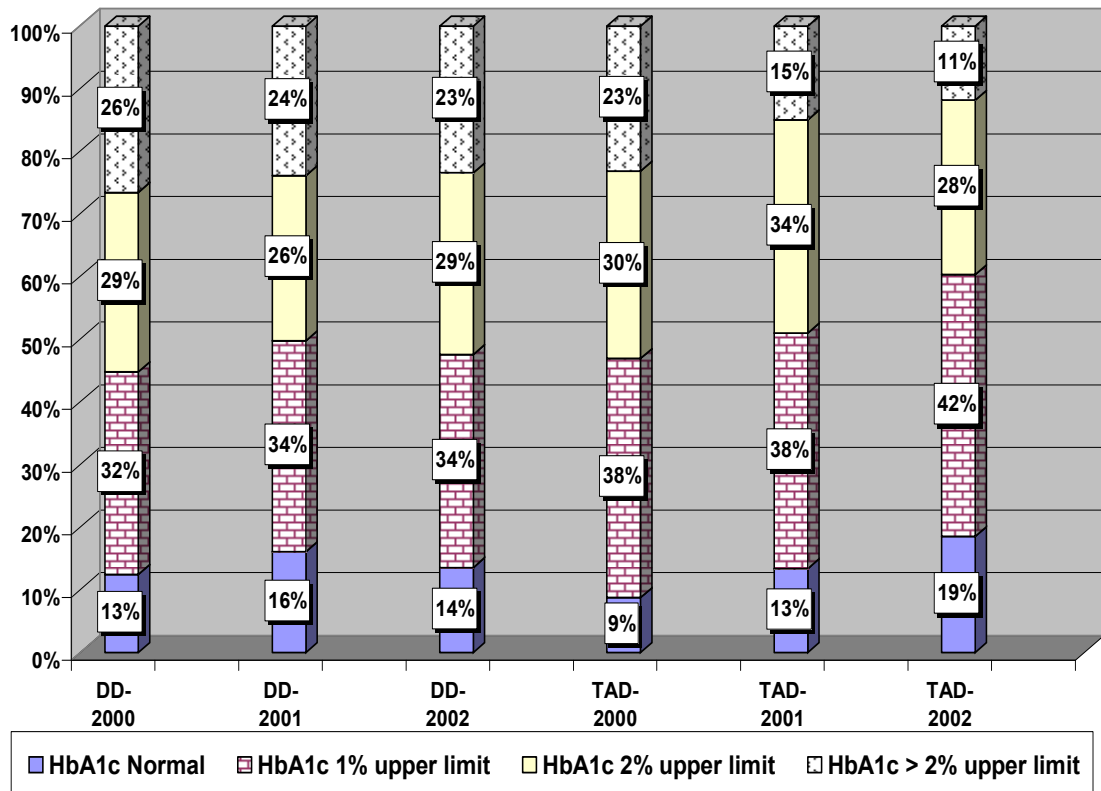
**Table 16: Comparison of changes in two groups in HbA1c during 2000 – 2002**

	2000-2001		Prob>F	2001-2002		Prob>F	2000-2002		Prob>F
	TAADIS	NDDP		TAADIS	NDDP		TAADIS	NDDP	
<b>HbA1c</b>	-0.24	-0.18	0.4436	-0.21	-0.03	<b>0.0002*</b>	-0.45	-0.15	<b>0.0002*</b>
<b>± SE</b>	0.08	0.03		0.07	0.02		0.08	0.03	

**d) Normal HbA1c:**

Calculation of the percentage of those within normal range or upper normal limit (UNL) of HbA1c was conducted. The normal range was calculated as (HbA1c = 4-6%), 1% UNL as (HbA1c ≤ 7%), 2% UNL as (HbA1c ≤ 7.2%), and above 2% UNL as (HbA1c ≥ 7.3%). In the year 2000, there were 9% of participants in TAADIS with HbA1c in normal range compared to 13% of participant in NDDP. In TAADIS, the number of participants with HbA1c in normal range increased from 9% in 2000 to 13% in 2001 and 19% in 2002. In NDDP, it increased from 13% in 2000 to 16% in 2001 and 14% in 2002. (Figure 13)

**Figure 13: Comparison of number of participants within normal range of HbA1c in TAADIS & NDDP**



**Comments:**

During 2000-2002, HbA1c decreased significantly in TAADIS, both within the group and between the groups (TAADIS & NDDP). In NDDP the HbA1c decreased in the period 2000 – 2002 but the differences between the changes in the two groups were statistically more significant in the TAADIS group. Also the percentage of patients with HbA1c within normal range was initially higher in NDDP and increased slightly in the year 2002. In the TAADIS group it was initially lower than NDDP but increased significantly during 2000-2002.

## **Body Max Index (BMI)**

### **a) Within the groups:**

#### **TAADIS**

The Mean ( $\pm$  SE) BMI changed slightly from  $30.9 \pm 0.5$  in the year 2000 to  $31 \pm 0.5$  in 2001 and  $30.9 \pm 0.5$  in 2002.

When comparing changes **within** the group in TAADIS, there were no significant changes in BMI from *2000 to 2001* ( $P = 0.9512$ ), or 2001 to 2002 ( $P = 0.9585$ ). Also in comparing *2000 and 2002* data ( $P = 0.9935$ ), there were no significant changes in BMI.

#### **NDDP**

The Mean ( $\pm$  SE) BMI changed from  $30.3 \pm 0.1$  in the year 2000 to  $30.1 \pm 0.1$  in 2001 and  $30.2 \pm 0.1$  in 2002.

When comparing changes **within** the group in NDDP, there were no significant changes in BMI from *2000 to 2001* ( $P = 0.4035$ ), or 2001 to 2002 ( $P = 0.8479$ ). Also in comparing *2000 and 2002* data ( $P = 0.5171$ ), there were no significant changes in BMI. (Fig 14)

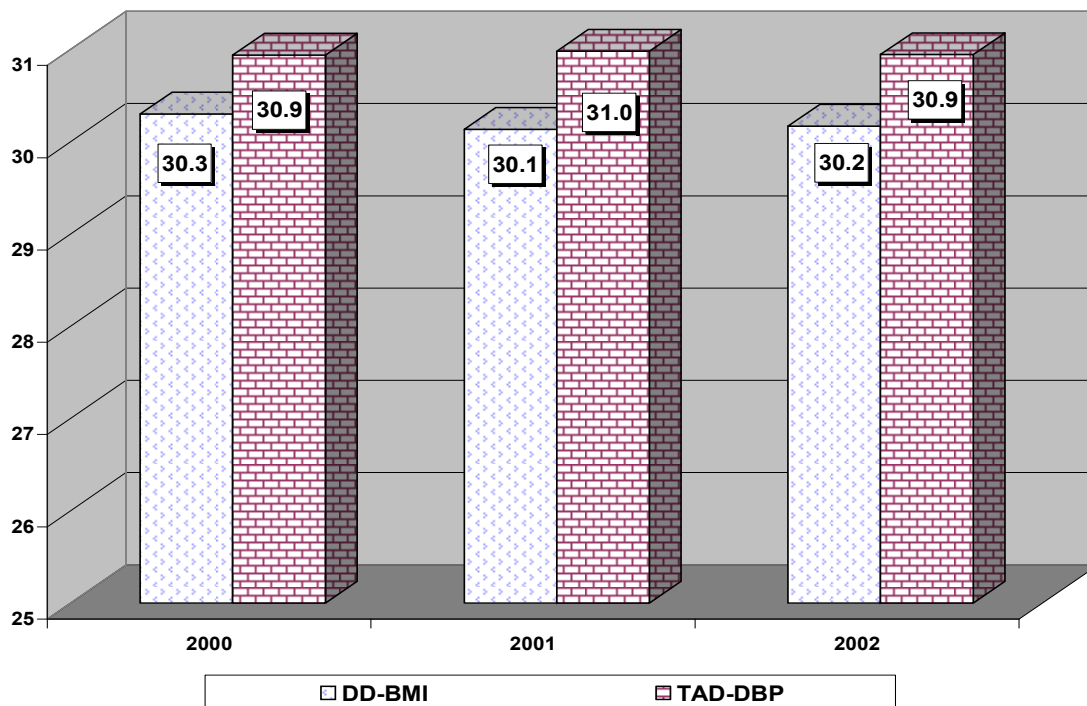
### **b) Between the groups:**

To compare changes **between** the groups (TAADIS & NDDP) Multi Analysis Of Variance (MANOVA) was used. The results showed no significant differences between the two groups in BMI ( $F = 0.161$ ).

### **c) Comparison of changes in BMI:**

When looking at the changes in T-CHOL during 2000 - 2001 and comparing the differences that occurred in both groups, the changes in TAADIS were more significant ( $P < 0.0001^*$ ). During 2001-2002, the changes were not significant ( $P = 0.2754$ ) but during 2000-2002 the changes were statistically significant ( $P = 0.0035^*$ ) (Table 17).

**Figure: 14 Comparison of BMI in TAADIS and NDDP during 2000 – 2002**



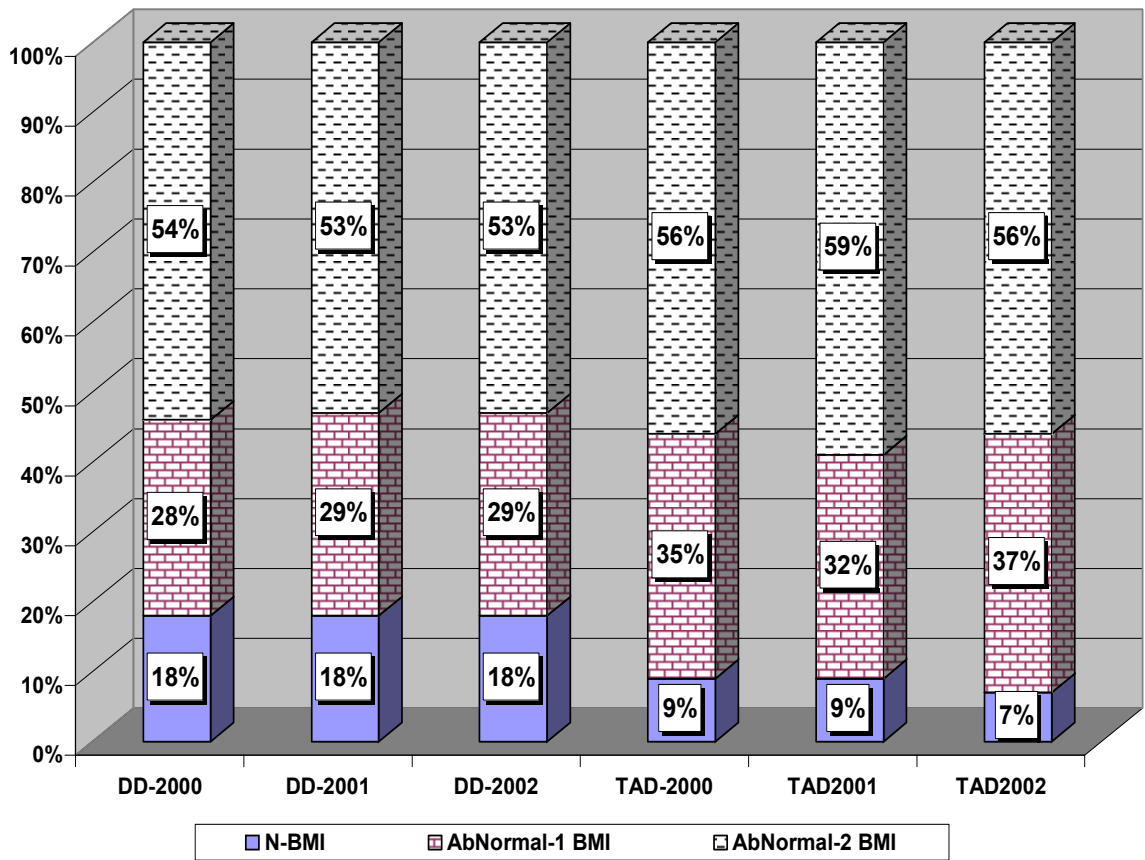
**Table 17: Comparison of changes in two groups in BMI during 2000 – 2002.**

	2000-2001		Prob>F	2001-2002		Prob>F	2000-2002		Prob>F
	TAADIS	NDDP		TAADIS	NDDP		TAADIS	NDDP	
<b>BMI</b>	0.04	-0.17	0.0921	-0.04	0.04	0.5909	0.01	-0.13	0.4113
<b>± SE</b>	0.11	0.04		0.13	0.05		0.15	0.06	

**d) Normal BMI:**

Calculation of the percentage of those within normal range of BMI or higher was conducted. The normal range was calculated as (BMI ≤ 25), AbNormal-1 as (BMI ≤ 25.1 to 29), and AbNormal-2 as (BMI > 29.1). In the year 2000, there were 9% of participants in TAADIS with BMI in normal range compared to 18% of participants in NDDP. In TAADIS, the number of participants with BMI in normal range did not change in 2001 but decreased from 9% in 2000 to 7% in 2002. In NDDP, it stayed as 18% through out the 3 years (2000 – 2002). (Figure 15)

**Figure 15: Comparison of number of participants within normal range of BMI in TAADIS & NDDP**



**Comments:**

During 2000-2002, BMI did not change significantly in TAADIS or NDDP. Both groups had more than 50% of their participants in the Abnormal-2 BMI range (> 29.1).



#### **4.7 Results in summary:**

- The number of participants increased in both groups from the year 2000 to 2002.
- The ratio of GPs who used the program in TAADIS was 33 / 67 % (F / M %) and in NDDP was 29 / 71 %, respectively.
- In TAADIS more GPs were working in a practice of 2 to 5 GPs, compared to NDDP. Also more than 80% of GPs in both groups were full time.
- The TAADIS groups had more Lipids and HbA1c but the NDDP had more results for BP and BMI.
- BMI did not change significantly in TAADIS or NDDP. Both groups had more than 50% of their participants in the Abnormal-2 BMI range (> 29.1).
- In NDDP, BP, LDL, T-CHOL, TG, and HbA1c reduced significantly within the group.
- In TAADIS, BP and HbA1c were significantly reduced and HDL increased.
- In comparing the changes between the two groups HbA1c was the only clinical indicator that was significantly reduced in the TAADIS group.
- The population reach increased in both groups.

## **5. DISCUSSION:**

A number of different factors could have contributed to clinical indicator changes. As TAADIS did not collect information on medication intake, its affect is not known. Also the severity and the duration of diabetes and other medical conditions that patients had were not documented. What is known is the monitoring system that TAADIS has is operated by a diabetes officer, so whereas CARDIAB has the facilities for reminding GPs of upcoming blood tests or visits for TAADIS such facilities are supported by the TAADIS officer who looks at the whole program and reminds the GPs. Such a reminder system could have contributed to the TAADIS group having more documentation of clinical indicators. Other factors could have been the involvement of practice nurses in reminding the patients of their next visits and conducting diabetes and other educational programs for them. Also the fact that GPs in the TAADIS group were involved in educational training and seminars for better diabetes management could have contributed to the results.

Although there were some data in NDDP regarding nutrition, alcohol intake, exercise and smoking, TAADIS did not collect this information. Therefore, the effect of changes in lifestyle that could have contributed to the results is not known. These areas need to be studied further to see if there is any correlation between the above mentioned factors. Also since it is not a random sample, the effect of this program in improving clinical indicators, for all diabetes patients, needs to be investigated.

In summary, when comparing the two groups, the TAADIS group had a statistically significant reduction in HbA1c.

## **6. FOLLOW-UP SUGGESTIONS:**

1. Additional variables included by NDDP, such as micro albumin, foot status, eye status, medication intake, duration and type of diabetes, are considered for inclusion in the TAADIS program by IDGP.
2. Standardised data cleaning template is used at every upload for both groups.
3. Recording of patient's attendance in educational sessions be used.
4. Collection of information regarding patient's life style is used.
5. The role of practice nurses and their involvement in patient's care are fully utilised.

## **7. CONCLUSION:**

In summary, both groups had some positive changes in clinical indicators within the group but only HbA1c was significantly reduced in TAADIS, when comparing the two groups.