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NATIONAL DIABETES PROGRAMME IN MALTA

FINAL REPORT

PHASE I: EPIDEMIOLOGICAL SURVEY ON DIABETES PREVALENCE

PHASE II: CLINICAL STUDY TO DETECT DIABETES COMPLICATIONS AND OTHER DEGENERATIVE DISEASES IN DIABETICS AND AGE-MATCHED NORMAL CONTROL SUBJECTS FROM PHASE I

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1. INTRODUCTION

The Republic of Malta consists of the main islands of Malta and Gozo with a total population of about 310 000, total land area of 316 m^2, and average population density of nearly 1000/km^2. Population growth is approximately 1%/year. The working population is approximately 37% of the total. The average family has four to five members.

It has been suspected for many years that diabetes mellitus is common among the Maltese population. This was emphasized by the studies of Professor Zammit Maempel (90) in which it was estimated that up to 20% of the total population had diabetes mellitus, mostly of the adult onset type. This estimated prevalence is far higher than in any European population, approaching the levels found in the Pima Indians (4) and inhabitants of certain Pacific islands (93). Diabetes and its complications are a considerable load on the resources of the health services. As a result the Ministry of Health of Malta approached WHO, Yugoslavia and Belgium requesting assistance to launch a diabetes programme. This resulted in the formation of the National Diabetes Programme in Malta. This programme is planned to cover various aspects of the epidemiology, natural history and clinical care of diabetes. More comprehensive health services for diabetics will be developed and facilities for education of local staff and patients provided.

2. BACKGROUND INFORMATION

The importation of food has for centuries been important in Malta. Together with food, culinary influences were imported - pasta foods from Sicily and Italy, several dishes from France and Britain (western food habits and style of eating), and aromatic dishes from Arabic countries.

Micallef et al. (44) pointed out five factors which are responsible for the limited national food resources in Malta. These are:

1. Shallowness of the soil.
2. Shortage of water.
3. Wind.
4. Land fragmentation.
5. Low educational standard of the farmers.

Livestock has always been limited on Malta due to the lack of pasture land. About 800 persons are employed in the fishing industry. Some fish is exported, but this amount equals imports.

The Gross National Product per capita is above US$ 3000. Most of the workforce are not involved in heavy physical work. Approximately 100 000 cars are to be found on the island and the average Maltese walks little.

Numerous data show that non-insulin-dependent diabetes (Type II) (85) is the major type found in Malta. There is considerable evidence which links this type of diabetes to present and previous nutrition of the subject, and the consequence of food intake - mainly obesity (28,31,60,79). A group of Maltese authors found indications of a very high incidence of obesity in the population in 1970. The same authors considered that overweight was one of the main factors influencing the high incidence of diabetes and the high incidence of cardiovascular diseases. They spoke of obesity (22) as being a "serious national problem".

In general, the Maltese population is well aware of diabetes, probably more so than any other European population. Many individuals have friends and/or relatives suffering from diabetes and are usually aware of the dangers associated with the condition (gangrene, amputations and even death).

3. STUDY DESIGN AND METHODOLOGY

3.1 and 3.2 Aims and objectives

General:

A. Immediate - the major objective of the programme is to develop and implement at the national level the most appropriate services for diabetes prevention, detection and control.

B. Long-term - in the case of its successful implementation, the diabetes programme could be used as a model for further development of prevention and control programmes for other major chronic diseases.

Specific:

A. Immediate:

(1) To estimate, by means of an epidemiological investigation of a representative random sample of the adult Maltese population:

(a) the distribution of diabetes and impaired glucose tolerance (IGT) in the given sample, using the new WHO criteria for the evaluation of the OGTT (WHO TRS 646);

(b) the possible role of consanguinity in the etiology of diabetes;

(c) the value of typical symptoms in the diagnosis of unknown cases of non-insulin dependent diabetes;

(d) to compare anthropometric and biochemical measurements, with particular reference to diabetes and IGT;

(e) to collect nutritional data in the sample, with the aim of assessing the magnitude and significance of "nutritional risk factors" in the incidence of diabetes (and its complications), obesity and other chronic diseases.

(2) To estimate by means of the clinical follow-up:

(a) the incidence and degree of diabetic complications (retinopathy, neuropathy, cardiovascular disorders, etc.);

(b) the incidence and degree of other chronic degenerative diseases;

(c) on the basis of (a) and (b) the services required.

(3) To design and initiate educational programmes for health personnel involved in diabetes care, for patients and for the general public.

(4) To improve existing health care services for diabetics.

The information derived from (1) and (2) will be necessary for carrying out (3) and (4).

B. Long-term

(1) To determine the following by means of the prospective follow-up of the sample:

(i) the incidence of diabetes mellitus in Malta;

(ii) the natural history of the disease in Maltese diabetics;

(iii) the possible relationship of certain characteristics with the development of clinically manifest diabetes.

(2) To develop and implement appropriate plans of care based on both the assessment of nutritional needs and the needs of other health care plans.

(3) To counsel individuals and families on nutritional principles, dietary plans, food selection and economics, adapting such plans to individual requirements.

(4) To carry out the activities outlined under (3) and (4) of section A on a continuous basis, using the information collected.

3.3 General plan of operation

Specific operations in the sample would follow the general pattern as shown:

Phase 0	Phase I	Phase II	Phase III	Phase IV	Phase V
Information sampling	Epidemio-logical survey	Clinical follow-up of compli-cations	Clinical follow-up of compli-cations	Clinical follow-up of compli-cations	Repeated epidemio-logical and nutrition survey
Study design	Pilot and general nutrition survey	Follow-up nutrition survey	Follow-up nutrition survey	Follow-up nutrition survey	
Summer/ Autumn 1980	Winter 1980/ 1981	Spring/ Summer 1981	Spring 1983	? 1985	? 1986

PHASE I METHODS

3.3.1 Sampling of study population

The selected sample consisted of 1100 households. The households were selected randomly from the electoral list by the Department of Statistics, Republic of Malta, and tests were performed to determine whether they were fully representative for the population of Malta. Criteria for the sample selection were usually related to questions concerning age, sex, education and occupation. There were approximately 600 families of salary earners, 200 families of farmers and fishermen, and about 300 of self-employed. The results of these tests are presented in Tables 1 and 2. A replacement group or reserve list of 200 households was also prepared (Fig. 1).

3.3.2 Recruitment of study population

During the preliminary check, the members of households were asked for basic information (education, employed members of the household). One thousand and ninety-eight households agreed to participate in the survey, 164 of them being replacements. It was decided to perform the survey in all subjects older than 15, in order to detect possible cases of non-insulin-dependent diabetes in the young (NIDDY). This provided a sample of 3040 persons in total. Between sampling and the survey there were some changes, e.g. some subjects left the island, moved out of the household or died; 95 in all. Thus the final sample comprised 2945 subjects (Fig. 1).

3.3.3 Data collection, clinical/epidemiological methods and standards

The subjects scheduled for each day were informed by a letter given to them by district health inspectors inviting them to attend fasting. A letter for their employers was attached (Appendix 1). The Federation of Malta Industries and the Chamber of Commerce were asked to offer their full cooperation (Appendix 2). The survey took place in regional clinics: for the northern region in Mosta, for the central region in Floriana, for the southern region in Paola and for Gozo in Craig Hospital, Rabat. Bus transport was offered to all the invitees, with special transport facilities for the disabled. At the clinic, they went first to reception where they were identified, a code number written on their questionnaire, and their name and date of birth recorded (Appendix 3). All were asked whether they had ever been told that they were diabetic. Those who gave a positive answer were interviewed by the diabetologist who then decided whether they would take the glucose load. Those on insulin treatment and those with a fasting blood glucose value of more than 200 mg/dl (determined with Dextrostix and "Eyetone" reflectance meter) did not have the glucose load. The other subjects went from reception to the laboratory where a fasting capillary blood glucose sample was taken from an ear lobe. A fasting urine sample was then collected. The subject than drank 75 g of glucose diluted in 250 ml of water and the time at which it was consumed was noted. The subjects were sent to the male/female check room, where specially trained nurses and medical students filled questionnaires and estimated blood pressure after 10 minutes sitting at rest. Weight (on daily calibrated scales) and height were measured, with subjects lightly dressed and without shoes. Skinfold thickness was estimated three times with callipers on the upper midarm. The mean value was recorded. The subjects then went to the waiting area where poll takers asked them about their nutrition. Exactly two hours after the glucose load a further capillary blood sample and urine sample were taken. After being offered coffee, the subjects were sent home. Again, free transport was provided.

Urine samples were tested with test-strips: fasting for glucose, proteins, blood and ketones and two hours after the glucose load for glucose and ketones. Blood samples were sent to the survey laboratory in the Pathology Department, St Luke's Hospital.

The following morning the findings were written into the questionnaire and the diagnosis was established according to the 1980 WHO criteria (85). Each subject received his findings by mail, one of the following four possibilities being marked:

1. Normal i.e. the subject does not suffer from diabetes.

2. The subject has impaired glucose tolerance. In that case the OGTT was repeated one week later. Those still in the IGT range were invited for a detailed check-up a few months later (Phase II). In the meantime they were advised to refrain from refined carbohydrates and to avoid overeating.

3. The subject is a diabetic patient. Both known or previously unknown patients were invited to St Luke's Diabetes Clinic by appointment. There they were advised about diet and other methods of treatment. They were informed that they would be invited for a check-up during Phase II.

4. Unclear OGTT findings. There were several reasons for this and usually one test out of two was abnormal. Generally this was a fasting blood glucose of 120 to 190 mg/dl with a two hour value of 50 to 60 mg/dl. Such subjects were invited for a repeated test.

If some other findings were pathological (high blood pressure, proteinuria, haematuria), these were noted. Such subjects were instructed to see their general practitioner or to attend a medical institution.

When subjects did not turn up for the survey, as per appointment, they were given the opportunity of coming on another day (or Saturday, for those who were working). For those who did not turn up, we repeated the survey in the same region a few weeks later. When there was no response to the second invitation subjects were offered the possibility of a third visit. Finally, a fully equipped team visited their homes as a "flying squad", collecting data from those who would otherwise have refused.

The filled and revised questionnaires were sent to the Department of Statistics where punch-cards were produced for data processing.

The questionnaire was then forwarded to the Department of Health for further use (Phase II).

PHASE II

3.3.4 Data collection and survey procedure

All actions within Phase II were carried out at Floriana Polyclinic for subjects from Malta and Craig Hospital for those from Gozo. Subjects were collected by district health inspectors and brought to the clinic by bus provided by the Ministry of Health. At reception, the subjects were identified, a questionnaire was given to them, as well as the one used in Phase I (to get the same number, to see previous diagnosis, treatment, etc.). According to the OGTT finding from Phase I, it was decided whether a subject should be given the glucose load. Thus diabetics (1) on insulin (2) with positive tests for urine ketones and/or two hour blood glucose >300 mg/dl in the previous OGTT were excluded from further glucose loading. In all subjects, a blood sample for glucose estimation (fasting) was taken from the ear lobe and a venous blood sample for the estimation of insulin, C-peptide, HLA-type, blood groups, urea, creatinine, uric acid, cholesterol, triglycerides, HDL-cholesterol, total haemoglobin and HbA_{1c}. Then subjects deemed suitable for the glucose load took 75 g of glucose in 250 ml of water. All subjects were then examined as follows (Fig. 1):

1. Ophthalmological examination with photography and slit lamp investigation.

2. Neurological examination.

3. ECG recording.

4. Oscillographic recording.

5. Anthropometry - height, weight, and skinfold thickness at four different points.

6. Cardiological examination and interview (Appendix 4).

7. Nutritional interview.

8. Dietary advice was given to diabetic and IGT subjects, and normal subjects suffering from metabolic abnormalities, e.g. hyperlipidaemia. Medication was sometimes given a week later, when they came for the results. Subjects given the glucose load had their second blood and urine sample taken two hours later. The subjects in whom only fasting glucose was estimated, were given in the meantime their medication (insulin) and a snack. Blood samples were sent to the respective laboratories for processing. The results were collected and recorded on the questionnaire. A result form was issued and given to each subject with diagnoses and recommendations a week later, when all the subjects were invited again. The second visit was also an opportunity to repeat sampling if errors had occurred (lost sample, ambiguous labelling, doubtful results, etc.). This visit was used in particular to repeat the OGTT in doubtful cases.

When evaluating the rescreened OGTT, the general policy was to accept the worse or more pathological finding, i.e. former (Phase I) diabetic - now IGT = diagnosed diabetic; former IGT - now normal = diagnosed IGT. The following instances were considered exceptional: as the same criteria were applied in Phase I and in doubtful cases the OGTT was repeated (so the diagnosis from Phase I was considered "weak"), and the outcome in Phase II, even after the repeated OGTT was fully normal, pathological findings were considered as occasional and not diagnostic. On the contrary, if the findings in Phase II were pathological, the subject was diagnosed diabetic or IGT, leaving further rescreening for later phases, when it would be possible to reconsider the diagnosis.

Blood glucose estimation was done in the laboratory established during Phase I.

3.3.5 Methods used and standardization

3.3.5.1 Diagnostic criteria

A subject was considered diabetic if the blood glucose level in his blood was equal to or above 120 mg/dl fasting and above 199 mg/dl two hours after the load. IGT was diagnosed if the fasting glucose level was normal, and the capillary blood glucose was between 140 and 199 mg/dl two hours after the glucose load.

The cases who did not fit into these criteria were arbitrarily considered according to the WHO guidelines (85), taking into account all the relevant data. These were mostly cases of previously diagnosed carbohydrate intolerance, who lost weight while on diet and now had to be considered completely normal or only IGT.

Criteria for hypertension

According to WHO (106) systolic blood pressure levels equal to or greater than 160 mmHg (21.3 KPa), and/or diastolic levels (fifth phase) equal to or greater than 95 mmHg (12.7 KPa) were considered pathological. Such subjects were considered to have hypertension and were treated as such.

3.3.5.2 Clinical methods

Retinopathy

Retinopathy was defined through any positive finding from "small red lesions" to "new vessel systems".

(a) presence of retinopathy;

(b) severity of retinopathy:

1. new vessel system;
2. exudates but not new vessels;
3. medium and/or large red lesions but not new vessels and/or exudates;
4. small red lesions only.

The listed criteria for severity were the same as those in the WHO Multinational Study of Vascular Disease in Diabetics (103).

Macrovascular disease

Diagnoses were based on the rules for the interpretation of the interview responses given in Cardiovascular Survey Method by Rose & Blackburn (104).

1. Angina pectoris	1.	Nil
	2.	Mild
	3.	Severe
2. Possible infarction	1.	Nil
	2.	Possible
3. Intermittent claudication	1.	Not diagnosed
	2.	Diagnosed
4. ECG	1.	Missing
	2.	Normal
	3.	Borderline
	4.	Abnormal

5.	Hypertension	1. Normal 2. Hypertensive
6.	Large vessel diseases	1. Nil 2. Stroke only 3. Intermediate 4. Severe
7.	Heart vascular disease	1. Nil 2. Positive
8.	Leg vascular disease	1. Negative 2. ECG showing major abnormality
9.	Stroke	1. Negative 2. Stroke

Microvascular kidney disease

This was assessed by estimating proteinuria and by measuring serum creatinine concentration.

CLINICAL PROCEDURE

The completion of the questionnaire (Appendix 4) and the clinical examination took place on the same morning.

Interview

(a) Cardiovascular disease

The questions were taken from reference 104.

(b) History of a "stroke"

The same questions were used as in the questionnaire of the Multinational Study (29).

(c) Visual disability

The question was mainly aimed at the patient's own assessment whether or not there was a visual disability which was not corrected by wearing appropriate spectacles or contact lenses (29).

(d) Smoking questionnaire

This was a modification of the one in Rose & Blackburn (104). Only the information concerning cigarette smoking was required.

(e) Dyspnoea questionnaire

This was also a modification of the one that was used in the WHO Multinational Study of Vascular Disease in Diabetics (29,103) (Appendix 4).

(f) Physical activity questionnaire

Data on physical activity were also collected from the examinees in the nutritional study. Examineees were asked detailed questions on kind and duration of physical activity (data will be presented in a separate study) (Appendix 4).

xamination

(a) Physical examination

(b) Blood pressure

A standard mercury sphygmomanometer was used, which was regularly checked. The WHO ecommendations for blood pressure measurements were used (106).

(c) Height and weight

Height (without shoes) and weight (indoor clothed, barefoot) were recorded in metric units.

undus examination

Mydriatric drops were instilled as soon as the patient arrived at the clinic. The examination was performed with a direct ophthalmoscope in a darkened room. Examination of ne fundus was completed within 120 seconds. Fundus photography was taken for each patient ith an "Olympus" fundus camera. The whole of the available fundus was examined.

efinitions:

(a) Small red lesions: having a diameter less than that of the retinal artery at the optic disc.

(b) Medium red lesions: larger than (a) but with the largest diameter less than that of the optic disc.

(c) Large red lesions: the largest diameter greater than that of the optic disc.

(d) Hard exudate: these should be distinguished from "colloid" or "Drusen" bodies. A hard exudate is white with a sharp outline. If they were large or extensive with a total area greater than that of the optic disc, they were included in "six or more" category.

(e) Soft exudates: enumerated as for (d).

(f) New vessel systems: it was sometimes uncerain whether only a few fine vessels were present or whether they were normal retinal components. The three categories "nil", "doubtful" and "definite" were introduced. The last category included all definite new vessels in the retinal or preretinal plane, as well as retinitis proliferans in all its forms.

esting electrocardiogram

Twelve lead resting electrocardiograms were performed and these were centrally coded by two independent observers (Mrs Keen and Mrs Rose). The same recommendations were used as in he WHO Multinational Study (103).

Neurological methods

The following functions were examined in all of the 397 subjects:

(a) cranial nerve normofunction or dysfunction;

(b) domination of one cerebral hemisphere over the other;

(c) a rough motor power of the extremities was examined and possible disturbances recorded. This was shown as: a subjective feeling of weakness; a discrete paresis; or a marked paresis.

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(d) muscular tone and its disturbances. These were defined as hypertonic (pyramidal or extrapyramidal) or hypotonic;

(e) possible presence of contractures was recorded;

(f) physiological reflexes (deep and superficial) and pathological reflexes (Babinski's reflex and its modifications, Strümpell's reflex and its modifications, Mayer's reflex) were investigated;

(g) sensation (sense of touch, pain, warmth, coldness, vibration, kinesthesia);

(h) possible presence of meningeal irritation;

(i) speech disorders of peripheral (dysarthria; anarthria) or central nature (sensor, motor or combined dysphasias - aphasia);

(j) autonomic nervous system disturbances (sweating, micturition, potency, nocturnal paroxysmal diarrhoea, tachycardia, orthostatic hypotension, lower leg oedema, trophic skin alteration, trophic arthropathy);

(k) psychiatric disturbances (neurotic disturbances, borderline cases similar to psychopathies, psychotic disturbances).

Diagnostic criteria

Diabetic neuropathies were divided into three basic groups:

1. Central diabetic neuropathy. This includes functional and/or morphological disturbances of the central nervous system.

2. Autonomic nervous system function disturbances

3. Peripheral neuropathies were divided into cranial nerve neuropathies and spinal nerve neuropathies. The group of spinal nerve neuropathies was divided into the following subgroups:

(a) sensory neuropathy;

(b) motor neuropathy;

(c) asymmetrical proximal neuropathy; and

(d) sensory motor neuropathy.

Within all the mentioned groups, the intensity of the disturbance was recorded in the following way: code 1 indicates the absence of signs and symptoms, code 2 indicates a suspected impairment, code 3 indicates a mild, and code 4 a marked neurological impairment.

Quality control in physical measurements

Height - the medical students estimating height were instructed to keep the head of the subject strictly in the so-called Frankfurt's horizontal position (eyebrow and top of the ear at the same level) and this was checked daily.

Weight - scales were calibrated daily with 6 x 10 kg weights. Subjects wore indoor clothes and were barefoot. 0.9 kg was automatically subtracted from the observed weight (75).

Body Mass Index (BMI) was calculated as $\frac{\text{weight (kg)}}{\text{height (m)}^2}$

Blood pressure - during the preparatory week, all nurses in the team estimated blood pressure in 10 volunteers (health inspectors, laboratory technicians and medical students). Blood pressure was estimated 6 to 10 times (each nurse twice or three times). Results were tabulated and four nurses who showed practically no variation between individual measurements were selected.

3.3.5.3 Nutrition

Sample size and survey procedure

Due to incomplete data or to a previously imposed diet restriction, the total dietary sample was 1912 subjects (1120 females and 792 males). Subjects stating that they were diabetics and on a diabetic diet (128 females and 72 males) were excluded from the sample and treated separately. Data from these subjects will be used later for reviewing the diabetic diet and for better education of diabetics. Family members were acquainted with the aim of the survey by the district health inspectors, who did the preliminary collection of personal data. Data for the nutritional survey were collected during the first visit to the survey centre.

The investigation was carried out in two phases, the winter (1980/1981) and summer (1981) phases, preceded by the pilot investigation.

Dietary survey techniques

Preparation for the pilot investigation lasted two weeks. During that time it was necessary to become acquainted with the dietary habits and lifestyles of the Maltese, local food names and recipes for dishes, availability and prices of foods, to select and train reliable staff, to prepare a book of specific Maltese recipes, to prepare food models and to compose a reliable questionnaire. This required visits to Maltese homes, hospital kitchens, restaurants, canteens, markets, supermarkets, dairies, bakeries, etc.

To make the data more reliable, the dietary history method was combined with the 24 hour dietary recall method. These two together are known as "total dietary survey technique".

I. Dietary history method. To collect data from 1912 subjects by means of a questionnaire - the food frequency method (Appendix 5) (30) was used. Twenty minutes were needed per subject.

The physical activity of the previous day and the difference in physical activity on a weekend day were recorded.

II. Twenty-four hour dietary recall method. Each fourth family out of the total sample, with members aged 20-60 years, was submitted to the detailed 24 hour recall method (Appendices 5,6).

The aim of the method is to estimate energy and nutrient intake. It took about 40 minutes per subject. Wives were asked in detail first, and after that the men reported about the food they had eaten (meals and in-between) during the previous day and on a weekend day (Sunday) (12).

Two hundred and ninety-five subjects were questionned and 287 were included in the final analysis. In 53 of these subjects, diabetes was detected during the survey.

In Phase II, all subjects were submitted to the detailed 24 hour dietary recall method for the following reasons: (1) to quantitate differences between winter and summer nutrition; (2) to give dietary advice to subjects in need (diabetic and IGT, as well as those with hyperlipidaemia, etc.), on the basis of their actual eating pattern (stated during the interview); (3) to establish as precisely as possible the magnitude of a prolonged effect of particular "nutritional risk factors" (e.g. obesity, high fat intake, low fibre intake) on the health of both healthy and diseased examinees.

Accuracy of the nutritional methods

Initially it was difficult to select the methods for dietary data collection. More detailed methods, such as the collection of individual histories or seven-day dietary records (95), were rejected as too time-consuming. We found, however, that the 24 hour dietary recall method could be substituted for the more time-consuming procedures in studies when more than 50 subjects were to be assessed (96,97).

The 24 hour recall method is used by most investigators at present. The large study performed by the United States Department of Agriculture (USDA) in 1965 was carried out in this way (98), as were the Ten-State Nutrition Survey in 1968-1970 (99), and the First Health and Nutrition Examination Survey (HANES) 1971-1972 (100). The most recent Nationwide Food Consumption Survey, carried out by the USDA in 1977-1978, also made use of the 24 hour dietary recall method (101). Collection of simple 24 hour dietary recall patterns was also the method chosen for MRFIT (102).

For these reasons, the 24 hour dietary recall method was chosen as the method for the investigation in the Maltese population.

3.3.5.4 Biochemical methods

The GOD-perid enzymatic method was used for blood glucose estimation. Quality control was performed throughout (Table 3). The accuracy of the estimation was checked daily by blood glucose estimation in known control sera. In parallel with the blood glucose estimation in samples glucose was estimated in control sera in the normal range (90 mg/dl), in the high range (300 mg/dl), and in the low range (40 mg/dl). All estimations were done in duplicate. An external quality assurance sample of unknown glucose content was checked two times per week. The precision of the method was also checked. The intra-assay coefficient of variation was 2.3%.

All biochemical methods were routine biochemical methods. The following tests were performed:

- plasma cholesterol (CHOD-PAP, Boehringer Mannheim)
- plasma triglycerides (kinetic UV method, Boehringer Mannheim)
- plasma HDL-cholesterol (precipitation with phosphotungstic acid and magnesium chloride, then CHOD-PAP
- plasma creatinine (Jaffé method without deproteinization, Beckmann Creatinine Analyser 2)
- plasma urea (urease/conductivity - Beckmann BUN Analyser 2)
- plasma uric acid (uricase method - Beckmann Glucose Analyser 2)
- HbA_{1c} (Isolab Fast Haemoglobin Test System).

Quality control data are shown in Table 3.

Insulin and C-peptide analysis

(1) Sampling

Blood samples were taken on E.D.T.A. in polypropylene tubes. Plasma was prepared by centrifugation and immediately deep frozen. Plasma was sent to the laboratory by direct flight in an ice box with dry ice and kept deep frozen until analysis.

(2) Insulin analysis

The "^{125}I Insulin RIA kit" from Bio-Mêrieux (France) was used. Two reference sera of human origin were analysed within each series. The following interassay coefficients of variation were found: for low level 14.3% and for high level 16.1%.

(3) C-peptide analysis

The kit used was "RIA-GNOST HC peptide" from Behringweke (Federal Republic of Germany). One reference serum of horse origin was analysed within each series. The coefficient of variation was 17.5% between assays.

Quality control for insulin and C-peptide

(a) External quality control

The laboratory participates in the external quality contol programme organized in Belgium for clinical chemistry.

(b) Internal quality control

In addition to the analysis of reference plasma within each series, the following controls were performed:

- about 10% of samples were analysed in different analytical runs; the results of duplicates were in agreement;
- a pool of plasma, prepared during the first week of sampling, was analysed with each run: the observed coefficient of variation was 17.2% for insulin and 13% for C-peptide.

This part of the survey was done by the Belgian team: P. Lejeune, P. Bruaux, J. Binet, Institute of Hygiene and Epidemiology; Director, Professor A. Lafontaine.

Human leucocyte antigen (HLA) typing

HLA situated on loci A, B and C were demonstrated by the two-step microlymphocytoxicity technique (73). One hundred and twenty different sera were used to recognize 44 specificities (18 for locus A, 20 for locus B, and 6 for locus C).

The double fluorescence technique was used to identify the DR locus (81). Thirty-six different sera were used to recognize 11 specificities.

This part of the survey was done by the Belgian team: C. Bouillenne, Service de Transfusion Sanguine of the University of Liège; Director, Professor A. André, P. Bruaux, G. Ducofre, Institute of Hygiene and Epidemiology, Brussels; Director, Professor A. Lafontaine.

3.3.5.5 Statistical methods

Data analysis

All data were transferred to punch-cards (80 digits per subject). The processing was performed at the University Computer Centre "SRCE" in Zagreb and all tables presented in this report were prepared there.

Statistical analysis

Statistical analysis of the results was performed using Student's t-test for comparison of mean values (BG, height, weight, BP, skinfold) and X^2 test for the proportional studies. We also used Garner, Pearson, Goodman, and Kruskal tests. The studied population in some instances has been age and sex adjusted to the 1979 census data for the whole of Malta.

Data analysis - Phase II

Completed questionnaires were sent to the Department of Statistics where punch-cards were produced (five cards per subject) for data processing. All data processing was done in the University Computing Centre "SRCE" in Zagreb, using the Univac 1100/42 system with the assistance of and in consultation with Mr P. Macasovic, Eng.

The original questionnaires are stored in the Department of Health as the records of the patients.

The following statistical methods were used:

1. Analysis of the nominal variables by means of contingency tables.

2. Simple correlation analysis.

3. Multivariate statistical methods and descriptive statistics.

4. Multiple linear regression.

Apart from the specially composed programmes the software used for the Malta Project included:

1. CONTAB package developed in "SRCE" for contingency tables.

2. UNISTAT 2 and DSTAT 2 programmes of the STATJOB programme system of the Academic Computing Centre, the University of Wisconsin, Madison, United States of America.

The original core questionnaire in Phase I was made of one record containing 80 positions.

The Phase II questionnaire was made of five records containing 80 positions. The punching procedure was performed in Malta. All data have been merged on magnetic tape into one record.

Nutritional data processing

Nutrition and food intake data were calculated from existing tables of composition and nutritive value of foodstuffs (69,55). Criteria used for the interpretation of dietary (11,23,61) and anthropometric findings (30,43) were those generally accepted and used in reference surveys.

The statistical package for the Social Sciences (SPSS) was used for data handling (50), but these results are not presented in the present report. They will be presented in a separate detailed report on the nutritional survey.

Age groups into which the examinees in the nutritional survey were divided, were chosen according to the criteria recommended by WHO (63), i.e. 16-35 years (young adults), 36-55 years (adults) and over 55 years (elderly adults).

4. RESULTS

4.1 Participation in the initial screening

See sections 3.3.1 and 3.3.2.

4.2 Characteristics of the sample population

The sample population is shown in Table 4. In total, 2149 subjects were tested: 1910 in Malta (88.9%) and 239 (11.1%) in Gozo. There were 955 males (44.4%) and 1194 females (55.6%). The overall response rate was 73%.

4.2.1 Age and sex

Table 4 shows the distribution according to the age groups, place of test, and sex.

4.2.2 Education, occupation, marital status

Table 5 shows the educational levels, marital status and occupation of the tested subjects.

4.2.3 Anthropometry

Two methods were tried to estimate adiposity: determination of weight and its relation to height and sex (30) and skinfold thickness (19).

Males were taller, while height decreased with age (younger examinees of both sexes were taller). In males, the mean height was 166.2 cm and in females 153.7 cm (Table 6). Males also tended to be slimmer than females. This difference was found mainly in the older age groups.

Obesity

In males with IGT, the highest BMI was found in the age group 25-34 years (30.9) and in females in the age group 65-74 years (34.4). In the diabetic patients, females had a higher BMI, the peak being in the age group 65-74 years (34.5). Mean BMI in new diabetics, particularly males, was higher than in previously diagnosed diabetics (Table 7).

Prevalence of obesity

Obesity was defined as BMI above 30, whereas subjects with BMI between 24 and 30 were considered as being overweight. The prevalence of obesity was higher among females than among males (Table 6).

Mean BMI was in the overweight range (BMI 25-30) even in the 25-34 years age group, while in some age groups (46-50 years) mean BMI was above 30, i.e. in the obese range. The increase in BMI was particularly evident in those with impaired glucose tolerance and with diabetes, the increase above the normal group being noteworthy in the younger age groups.

Triceps skinfold thickness (TST)

The pattern of TST followed the pattern of obesity estimated by BMI (Table 8). Only 13 males had TST greater than 25 mm, whereas 571 females had skinfold thickness greater than 25 mm.

Table 8 presents the mean values of TST. According to Jelliffe's criteria, the males with a mean value of 10.2 are about 80% of the standard (12.5), while the females, with a mean value of 26.3 are far above the standard value (16.5).

4.2.4 Blood glucose distribution and 4.2.5. Classification

In Table 9, distribution of subjects according to the final diagnosis is shown. 86.7% of all subjects were considered normal according to their OGTT findings, 5.6% showed IGT, while diabetes was found in 7.7% of the subjects (1.8% newly diagnosed and 5.9% previously diagnosed).

Table 10 shows distribution of subjects with normal glucose tolerance according to sex, age groups, and place (Malta and Gozo). IGT cases are shown in Table 11. In younger age groups (less than 54 years) there are more cases of IGT in females. Above this age, males prevail. In both sexes, most cases occurred in those older than 45 years.

Distribution of diabetics using the same criteria is shown in Table 12. One can see that only three new cases were diagnosed under the age of 35 years. Seventy-five per cent. of diabetic patients were older than 55. In women, a sudden jump in the number of cases can be observed after the age of 45 years. In the age group 65-74 years, every third female is a diabetic. Diabetes was generally more frequent in females. Diabetes was found in 19.4%

of all females older than 45 years, compared with 12.0% of males of the same age. Table 13 shows sex and age of the patients (diabetics and IGT). Distribution of subjects by sex, BMI and fasting blood glucose, excluding previously-known diabetics, is shown in Table 14. Distribution according to BMI and sex shows that the number of subjects with higher fasting blood glucose increases with weight (expressed as BMI), particularly in the females.

Fig. 2 shows graphically the age and sex distribution of fasting and two hour post-glucose load blood glucose values by age for the whole population. Fig. 3 shows the distribution of fasting blood glucose values in the total sample minus known diabetics.

In a number of subjects, the diagnosis of diabetes was established before the survey. In order to establish new diagnostic criteria, we submitted them to the 75 g glucose load: 7.5% of males and 10.7% of females were such cases. Of these, 43.5% were on diet only, 43.0% on oral hypoglycaemic agents and 13.5% on insulin (Table 15). After revision of the diagnosis, approximately the same number of examinees were treated with insulin as before, whereas many of the diet-treated patients passed into the normal group (non-diabetics). Of subjects previously diagnosed as diabetics 23.5% were found to be normal, 13.0% showed IGT (18.0% males, 10.1% females), and 63.5% remained with the diagnosis of diabetes mellitus. This could be a consequence of new, more strict WHO diagnostic criteria, adequate treatment, reduced body weight (between diagnosis and the survey), and in some cases because the diagnosis of diabetes was based on non-diabetic glycosuria only (Table 16).

Urine glucose values, fasting and two hours post-glucose loading are shown in Table 17. The lack of diagnostic sensitivity and specificity is clearly shown. It can also be seen that if a fasting urine specimen contains 0.5 g/dl glucose the subject is highly likely to have IGT or diabetes.

There were 38 newly discovered cases of diabetes (23% of all diabetic cases in the survey), 1.8% of the total sample (Table 12).

(a) Newly diagnosed diabetics

Distribution of the newly diagnosed diabetics according to age and sex is shown in Table 12. Only three males were under the age of 44, while all others were above the age of 45. The majority of known Maltese diabetics belong to this age group. Table 14 shows the mean BMI of the same group.

4.2.6 Other clinical symptoms

Occurrence of certain symptoms, usually found in diabetics, is shown in Table 18. There was a trend of increasing frequency of symptoms from normal through IGT to diabetic groups. In general females with IGT or diabetes had a higher frequency of symptoms than males.

Some drugs can influence the OGTT, or precipitate diabetes. The results indicate that the number of subjects taking oral contraceptives (n = 19), blood lipid lowering drugs (n = 12), and cortisone (n = 7) is extremely low. Oral diuretics (5.3%) and hypotensive drugs (6.9% of the total sample) were taken by more IGT and diabetic subjects than normal subjects (Table 19).

4.2.7 Blood pressure

Mean systolic and diastolic blood pressure and hypertension distributed according to age and sex are presented in Table 6. In younger age groups males had a higher BP, whereas in all age groups above 45 years females had higher BP. Mean BP for males was 134.3 mmHg systolic, and for females 135.8 mmHg. Diastolic BP was higher in females with a peak of 99.1 mmHg in the age group 65-74 years. Mean diastolic BP in males was 81.9 and in females 84.9 mmHg.

It has been estimated that overweight subjects have a 1.5 to three-fold greater prevalence of hypertension than normal weight subjects (71). Table 20 shows the same trend in the Maltese population. In the group with higher body weight (BMI) there are more persons with elevated systolic or diastolic blood pressure. Most cases of hypertension are in the older age groups and are female.

4.2.8 Nutrition

Results of the dietary history method

Table 21 shows age and sex distribution of the total dietary and nutrient intake sample. Table 22 shows the distribution of body weight and height related to sex and age, and how the values differ from standards taken from tables, and the degree of adiposity of each group (43).

This is presented graphically in Fig. 4, where differences between the standard and actual body weight are shown for females. The same differences for males are shown in Fig. 5. It is obvious that older people in Malta are obese (67).

Tables 23, 24 and 25 show food frequency intake. All subjects of the dietary sample (1912) were asked how often they consumed certain foods - daily, weekly and monthly. The answers were divided into three categories: those foods taken three times weekly and more, less than three times weekly, and those never used.

Regularity of meals

A regulated food intake in a proper diet is as important as the quality and quantity of food consumed (33). The average Maltese, particularly those working (but also their wives at home) have at most one full meal daily, while all others are minor snacks (8).

Results of the 24 hour dietary recall (nutrient intake)

Phase I: The amounts and ratios of particular nutrients were obtained by processing the data collected in 287 examinees randomly chosen from the total dietary sample, using the 24 hour dietary recall method. The most recent nutritional criteria, used worldwide at present, were used as a comparison (Fig. 6) (16,52,70). Most notable is the increase in total fats in the Maltese diet.

Table 26 shows the percentage contributions of different nutrients to the total calories.

Table 27 shows the absolute quantitites consumed of particular nutrients.

Cholesterol

Recent criteria recommend a maximum daily intake of 300 mg cholesterol (18). As can be seen from Table 27, the average intake of cholesterol in Malta is three to four-fold higher. This is presumably related to the high serum cholesterol levels found.

Energy

The preliminary results show excess calorie intake, especially during weekends.

The intake of total calories in both males and females, presented in Table 27, shows very high values.

Dietary fibre

The intake of dietary fibre might conceivably be a protective factor for certain diseases, including diabetes (89). In Malta relatively less fruit, leguminous and leafty vegetables, etc. are bought, so that a low fibre intake might be expected. In the survey we used Southgate's tables (68) and we found a low intake of foods rich in fibre.

Table 28 shows the quantity of dietary fibre expressed in grams for winter and summer phases.

4.2.9 Heredity

Table 29 shows the family history for diabetes in Phase I subjects. Mothers of probands were twice as often diabetic as fathers. Grandparents of females were frequently diabetic; one-third of the total sample indicated one or more parents as diabetics.

The possible consanguinity in our subjects was also one of the questions. The results show that 2.3% of males and 3.8% of females had parents who were close relatives. The distribution of degrees of consanguinity (relatives) was almost equal. The results show that consanguinity can hardly be accepted as a cause for the high incidence of diabetes. It is also worth noting that nearly 50% of IGT and diabetic subjects had one or more diabetic relatives compared with one-third for the normal group.

4.2.10 Relation between different estimated parameters: Phase I

Table 30 shows covariance means for different measured variables in IGTs, normals and diabetics. Blood glucose levels were obviously different between groups. There were also significant differences in other parameters. Thus in both sexes systolic and diastolic blood pressure and BMI were significantly different between normals and IGT subjects. Notable differences in blood pressure between normals and diabetics were only seen in females.

4.2.11 Characteristics of non-responders (Phase I)

A total of 27% of the scheduled sample did not attend the survey. Presumed reasons and the background of non-participation are referred to in section 4.1. Due to the high number of non-responders an investigation was carried out to estimate their age and sex structure, with special emphasis on the number of known diabetics. The investigation was performed in September 1982 by district health inspectors, who visited homes of non-responders and asked a few relevant questions. The results are summarized in Table 30. A total of 850 subjects did not attend the survey procedures. Out of these, 18 (2.1%) were diabetic before February 1981. This rate was the same in Malta and Gozo. Table 30 viewed in conjunction with Table 4 shows that non-responders were younger, and more often male than female. Subjects of less than 34 years formed 52.9% of the total of non-responders in Malta, and 40% in Gozo. As diabetes is rare in this age group, the true prevalence of diabetes in Malta is less than that estimated in the respondents, but probably not less than 6.5%.

4.3 Eligibility and participation in clinical survey (rescreening)

The sample comprises all diabetic and IGT cases from Phase I and a control group of normal (non-diabetic) subjects.

4.4 Characteristics of rescreening sample

4.4.1 Age and sex

The sample population is shown in Table 32. Three hundred and ninety-seven subjects in total were tested - 181 normal control persons (120 males, 61 females), 83 IGT cases (39 males, 44 females), and 133 diabetics (47 males, 86 females). If we compare this table with Table 10 (Phase I), it can be seen that more than two-thirds of IGT cases and diabetics responded. In normals, there were 184 out of 270, i.e. three-quarters. Reasons for the low response and comments on this can be found under section 2.1.2. Additionally, for technical reasons, the institution of the second, third, and further calls was not applied in Phase II. Subjects were, however, informed about the possibilities of attendance on any day using their own transport.

Looking at Table 32, where final diagnoses are listed, several changes are obvious: the number of IGT cases decreased by two and the number of diabetics increased by 10. In Table 32, the group with the final diagnosis "normal" is divided according to previous diagnosis. Four IGT cases and two diabetics from Phase I showed normal glucose tolerance on retesting in Phase II.

Table 32 also shows that in the IGT cases, 13 were earlier considered normal, 67 were IGT in both phases, whereas one subject, who was earlier considered diabetic, turned out to be IGT on retesting.

4.4.2 Anthropometry

Anthropometry variables measured in this phase were height, weight and BMI. Other variables (skinfold thickness) will be the subject of a separate report.

Body mass index

The distribution of BMI according to sex, age groups and final diagnosis is shown in Table 33. There were no significant differences between normals, subjects with IGT and diabetics when groups were age-matched.

4.4.3 Biochemical findings

Plasma triglycerides (Table 34)

Mean values of plasma triglycerides were higher in the IGT subjects and diabetics than in normal subjects. Even the mean values were at pathological levels in some groups, particularly in the older subjects.

Plasma cholesterol (Table 35)

Significant differences in mean levels were found for cholesterol between both normal and IGT females and normal and diabetic females. Generally, females showed higher levels of cholesterol than males with many values in the pathological range.

Plasma HDL cholesterol (Table 36)

There were no differences between the groups. Females showed higher HDL-cholesterol levels than males.

Blood haemoglobin A_{1c} (Table 37)

As expected, HbA_{1c} levels increased significantly with worsening of glucose metabolism. All groups differed, normals being lower than IGT cases, and these in turn were lower than diabetics. Females had significantly higher levels of glycosylated haemoglobin than males.

Plasma urea (Table 38)

Mean values were higher in IGT females and diabetic females compared with normal females. However, all values were within normal limits. The increased mean urea and creatinine values in the group of males aged 45-54 years result from a newly detected diabetic with previously diagnosed uraemia which was included in this group.

Plasma creatinine (Table 39)

Mean values of plasma creatinine did not display any major differences with the exception of the male diabetics in general showing lower values than normal males.

Plasma uric acid (Table 40)

Uric acid levels showed no differences between groups.

Plasma C-peptide (Table 41)

It would be expected that C-peptide level would be lower in diabetics. This was true, however, only for males.

Plasma insulin (Table 42)

Fasting plasma insulin levels were similar in all groups, although values tended to be lower in diabetics. This should be viewed in conjunction with blood glucose values suggesting inappropriately low insulin values in both IGT and diabetic groups. The high values in all groups were presumably the result of obesity.

4.4.4 Clinical data and complications

4.4.4.1 Oscillography

Oscillographic findings, coded as normal or decreased, are shown in Table 43, according to the final diagnosis. The percentage of pathological findings increased with the deterioration of metabolic state: IGT cases had more pathological findings than normals, and diabetics more than IGT subjects. The most striking change was in the newly diagnosed diabetics.

4.4.4.2 Blood pressure

Blood pressure findings (Table 44) suggest a trend towards an increase in subjects with IGT compared to normals, while there are no significant differences between IGT and diabetic subjects. Regarding diastolic blood pressure, the only significant difference was between normal and diabetic females. It is also worth noting that females in general have higher blood pressures than males.

4.4.4.3 ECG findings

Out of 392 completed ECG findings (Table 45), 286 (73.0%) were normal, 80 (20.4%) borderline and 26 (6.6%) pathological. Table 45 shows the distribution of normal ECG findings according to sex and diagnosis of diabetes.

The incidence of borderline ECG findings was almost three times larger than of frankly abnormal recordings. Both borderline and pathological ECG findings were much more frequent among diabetics than among normal control subjects. Sex distribution was also interesting with one-third of diabetic females having a borderline ECG finding. In diabetic females, the ECG changes were not different from those in normal females. In males, a borderline ECG was three times more frequent in diabetics. It should be noted that data have not been age adjusted.

4.4.4.4 Large vessel disease - clinical occurrence

Stroke

There were five cases in total, one normal female, one IGT male and three male diabetics. These cases are also included among other large vessel diseases (Table 46).

Large vessel diseases

Automatic diagnosis was based on the rules for the interpretation of the interview responses given in Cardiovascular Survey Method by Rose & Blackburn, pp. 174-175, WHO Monograph No. 56 (see section 3.3.5.2).

Table 46 shows the sex and diagnosis-oriented distribution of large vessel disease. Out of 397 subjects, only 26 (6.5%) had severe LVD, but 23% had an intermediate form. In normal subjects 5.1% had severe and 19.4% intermediate severity LVD. Intermediate LVD was the most frequent complication, regardless of the final diagnosis (from 13% in normals to 36.4% in previously known diabetics). Of newly detected diabetics 26.3% had severe large vessel disease; however, the number of patients is too small for any valid conclusions to be drawn.

Heart vascular disease

This diagnosis was found in 28.5% of all subjects (24.0% of them were normals, 19.5% IGT subjects, and 39.2% diabetics). Again, diabetes was a substantial risk for the development of such conditions.

Angina pectoris

Angina was not frequent: only eight subjects reported severe symptoms.

Possible infarction

Here again the numbers were small: 3.25% of all subjects had possible infarction. Of these, only one subject was in the normal group, 6.1% were IGT subjects and 4.9% were diabetics.

Smoking

Of the total group, 57.3% had never smoked, 13.7% had stopped smoking, and 14.0% smoked up to 14 cigarettes a day. The highest percentage of heavy smokers was found among non-diabetics. Although smoking is frequently mentioned as a risk factor for large vessel disease, this was not apparent in the present survey (Table 47).

Correlation of possible contributing factors to large vascular disease

Table 48 shows regression coefficients for the various risk factors for cardiovascular disease. It is obvious that in diabetics (Table 48) large vessel disease correlated with age, systolic and diastolic blood pressure and the existence of diagnosed hypertension. The same was true for normals but smoking also appeared significant, while in IGT cases the only significant contributing factor was age.

With respect to heart vascular diseases (Table 48), systolic and diastolic pressure, smoking and hypertension are significant factors in normals, age and systolic blood pressure in IGT cases, while in diabetics risk factors are the same as in normals, although without a significant contribution from smoking. For ECG changes (Table 48) contributing factors were the same. Strokes occurred so infrequently that meaningful analysis was not possible.

The only significant correlations for peripheral and vascular disease were found in diabetics with hypertension and cholesterol level.

4.4.4.5 Small blood vessel disease

Microangiography is the morphological basis for the late diabetic complications. In this survey we concentrated on retinal and kidney changes, the retinal ones being proved by ophthalmoscopy and small vessel disease of kidney being indicated by the presence of proteinuria and elevated serum creatinine levels.

Small vessel disease in the eye

Subjects were divided into four groups: severe, medium, minimal and negative, according to the changes found. In the normal control group only one subject was found with severe small vessel disease of the eye. The same level of eye changes was found in 13.3% of all male diabetics. Medium vascular changes in the eye display an increase from normals towards diabetics (normals - males 1.8%, females 4.6%; IGT males - 7.7%, females 5.4%; diabetics - males 21.7%, females 22.5%) (Table 49). Minimal changes were the least frequent. Thus every third diabetic patient has severe or medium retinopathy.

Small vessel disease of the kidney

More of the subjects in the normal and IGT groups had severe kidney changes. In diabetics, such changes were present in five males and four females. In normals, females showed more minimal kidney changes.

Some attempts were made to compare the possible influence of several other factors on small vascular disease (systolic and diastolic blood pressure, BMI, cholesterol). The figures were too small to show any signficance. No obvious relationships were suggested.

4.4.4.6 Neuropathy

The importance of diabetic neuropathy led us to include a neurological examination in Phase II. Only reliable and reproducible clinical methods were selected (6,32,56,57,58).

Central nervous sytem

In the group of 395 examinees, 15 had signs of CNS disturbance (1.0% in the diabetic group, 1.8% of examinees with signs of upper motor neurone impairment were found) (Table 50). Two subjects did not undergo neurological examination.

Autonomic nervous system

In the group of 179 control subjects of both sexes, 56.4% showed no disturbance of the autonomic nervous system. Suspected impairment was present in 42.4% and a mild disturbance was found in 1.2%. In the IGT group, 45.7% were unaffected, 53.1% had a possible impairment, whereas a mild lesion was observed in 1.2%. In diabetics a mild impairment was established in 1.4%, a suspected lesion was present in 61.3%, whereas no abnormality could be found in 37.3%. Statistical analysis showed a signficiant probability that diabetes was associated with autonomic neuropathy ($p = 0.022$) (Table 50).

Peripheral neuropathy

Impairment of the outer eye muscle innervated by the oculomotor nerve was found in only one subject - a diabetic. In 14 males (6.7%) and six females (3.1%) supranuclear cranial nerve impairments were found, accompanied by other signs of upper motor neurone lesions. These patients were included in the group with central nervous system involvement.

Spinal nerve neuropathy

(a) Sensory neuropathy

No differences were found in sensory neuropathy between the groups divided according to sex.

(b) Motor neuropathy

A clear interdependence was found between diabetes and lower motor neurone lesions (Table 50). In the group of 142 diabetic patients, 40.8% showed possible lower motor neurone lesions. In the IGT group suspected lesions were found in 32%. The equivalent figure for normal subjects was 22.1%.

(c) Asymmetrical proximal neuropathy

Such a clinical picture was found only in one female patient with already diagnosed diabetes. A prevalence of 3% has previously been suggested (54).

(d) Sensory motor neuropathy

This is the most frequent distal symmetrical type of diabetic impairment of the lower motor neurone. Such a disturbance was suspected in 7% of normal controls, in 13.6% of the IGT group, and in 19.7% of the diabetics ($p = 0.007$).

4.4.5 Correlation of laboratory and anthropometric findings - Phase II

Table 51 presents variables and their correlation from the Phase II Study. As expected: weight was correlated with height and BMI; height with BMI (negative); systolic blood pressure with diastolic pressure, age and BMI; diastolic BP with age; fasting blood glucose with blood glucose two hours after loading and with HbA_{1c}; total cholesterol with triglycerides; and triglycerides correlated negatively with HDL cholesterol. HDL cholesterol was negatively correlated with height. Serum insulin and C-peptide were also correlated.

4.4.6 Nutrition - Phase II: results

The second phase of the nutritional investigation in Malta was aimed at establishing, inter alia, the differences in nutrition of the population between the summer and winter periods. Seasonal differences were expected, but the so-called "food-year" is more marked in countries which import food. The summer phase results presented in Tables 52 and 53

should be compared with those obtained during the winter phase, presented in Tables 26 and 27. Differences are found with regard to energy, fat and carbohydrate intake (presented graphically in Fig. 7) whereas the cholesterol intake was high in both seasons and the dietary fibre intake during summer was slightly lower in females than the already low winter intake (Table 28). It should be noted that the populations tested were different so that results may not be strictly comparable in the two seasons. An overall comparison between Maltese and recommended diets is shown in Fig. 6. A higher fat intake may be mostly attributed to the summer consumption of "hobz è zeit", a favourite Maltese food the major constitutent of which is bread soaked with oil. Total carbohydrates are also lower than recommended mostly due to a lower complex carbohydrate intake.

A more detailed analysis of diet and its relation to other variables will be presented in a separate report.

4.4.7 Results of HLA typing

Diabetes mellitus is considered to be in part hereditary. Determination of HLA types shows several correlations with chronic degenerative diseases, including diabetes mellitus, but only in the insulin-dependent (Type 1) variety.

In Maltese patients (diabetic and IGT) who were mainly non-insulin dependent no significant associations were therefore expected, or indeed found.

The results of these investigations may none the less be of interest in a more general sense, because:

1. HLA typing has now been performed for the first time in the Maltese population. The size of the sample (more than 400) should give a reasonable indication of antigen distribution in the Maltese inhabitants.

2. The results of this investigation will be of assistance in preparations for future organ transplantations within the Maltese population.

The complete results of this part of the survey will be the subject of a separate report.

4.4.8 Characteristics of non-responders at rescreening

Table 54 shows the non-responders from Phase II according to age group, sex, BMI and final diagnosis from Phase I. Numbers in the group of normals do not display actual non-response, because the normal group was a selection of 10% of normals, age and sex adjusted to diabetics and IGT subjects. This list was given to the Department of Health for the recruitment of subjects (our intention was not to know which normal subject was a counterpart of a particular patient). Non-responding patients were most frequent in older age groups (in which also there are most patients; Table 13). Newly detected diabetics were most likely not to appear. Known diabetics in the age groups 55-74, females more than males, also failed to turn up.

It thus appears (see also section 4.2.11) that approximately one-third of subjects did not react to appeals and invitations. In very different populations the fraction of non-responders was surprisingly similar (105).

5. DISCUSSION

The results of the screening for diabetes mellitus in the sample indicate several points of importance and risk factors for the development of disturbances of carbohydrate metabolism and their consequences.

5.1 Age

Subjects of both sexes above the age of 45 years are more likely to develop diabetes. As shown in the tables, the percentage of cases of diabetes, increased dramatically after this age.

5.2 Sex

Females are more likely to develop diabetes, especially in the age groups in which diabetes is more frequent, while the diagnosis of impaired glucose tolerance is more frequent in males and increases with age.

5.3 Inheritance

As almost all of our subjects had diabetes in their family history, it is difficult to distinguish the epidemiological importance of family history. Certainly, diabetes in the family history is important for the expression of diabetes in subjects, but other environmental factors overwhelm and "cover" the importance of family history. These environmental factors are important in Malta.

5.4 Obesity

Obesity is one of the most important asociations with the development of diabetes mellitus. Our results indicate that the high prevalence of obesity in the Maltese population could be one of the leading factors causing the high prevalence of diabetes in this population. The main factor contributing to the occurrence of obesity is overeating related to tradition and sociocultural factors on the island.

A lack of exercise may also contribute to obesity.

Phase II, which has been successfully completed was the first step in a thorough follow-up of the chosen Maltese sample. Medical and social benefits will be more apparent when the whole programme is completed but some preliminary comments may be made now.

The incidence of chronic degenerative complications in the population studied was a little higher than average. The differences were not dramatic but do indicate that health services should provide adequate resources. One should not expect too much success in the treatment of such conditions but all possible approaches should be employed because without treatment all the degenerative complications will eventually lead to serious disability.

Local medical staff obtained an insight and experience in organizing and performing modern outpatient consultations, an experience which could be transferred to the newly established outpatient clinics and used for the benefit of the population, including others besides diabetics. We hope that the Maltese health services will continue such work routinely so that future actions will be taken more and more by the local staff. Therefore, both aims of the programme should be fulfilled: introduction of modern medical methods and then use by local staff.

Regarding the complications, Phase II has shown that diabetes carries a considerable risk for the development of myocardial, peripheral vascular, ophthalmological and neurological disorders. Smoking was not proved to be a risk factor for vascular complications (as in the WHO Multinational Study), but obesity was. The purpose of the exercise was not to establish new scientifically relevant facts, but to establish facts relevant for the Maltese population. In that respect differences from established data will become obvious only after repeated surveys, because the sample was too small for proper comparative epidemiological conclusions to be drawn.

One of the most interesting findings of the survey was that the frequency distribution of blood glucose in the Maltese showed a tendency to bimodality. This is not a very frequent finding elsewhere, although it has been found in several isolated communities with a high incidence of diabetes, e.g. Pima Indians and some Pacific islands. This bimodal distribution can be found only in populations where diabetes is frequent, and when the sample is large enough. Both conditions were fulfilled in our survey. It will be important to follow the population further in order to see other possible specificities of the type of diabetes found, and of the population studied.

When diabetes detection drives started, about 30 years ago (Krall, 3,83), one unknown diabetic was found for every known one. Thus, in most investigated populations, where the percentage of known diabetics is about 2%, surveys result in another 2% of diabetics being found. Interestingly, we found the same percentage of new diabetics in Malta was 1.8% (1.6%

males, 1.9% females). It appears that the only difference between this and other populations studied is the higher percentage of known diabetics, i.e. 5.9% (4.5% males, 7.0% females).

Glycosuria is one of the signs of diabetes, sometimes also used as a diagnostic criterion. In our study, glycosuria after glucose loading was more frequent that the diagnosis of diabetes or impaired glucose tolerance. It has been stressed several times before that glycosuria may lead to a falsely positive diagnosis. This is also indicated by our findings.

Nutrition. Diabetes is a syndrome the onset of which is related to several risk factors, of which the environmental impact - first, that of nutrition - is among the most important (106,107).

The importance of obesity has been stressed (65), and, as stated above, appears to be of overwhelming importance in Malta. In total, about 61% of males in the sample had body weights above standard, while 67% of females were in the same range. Body weight on Malta displays a tendency to decrease when the age is above 50 years, but if a person weighs 75 kg and is 53 years old, he has 7 kg of fat more than he had when he was 25, although body weight has remained the same (10).

Excess calorie consumption appears to be the main cause of obesity in Malta. The main foods purchased are flour, sugar, pasta, eggs, oil, cheese (fat-rich), red meat (cholesterol + fat), and soft drinks, mostly high in carbohydrate, fat and energy, and low in nutritional value.

The Maltese cuisine, which is a mixture of western, south Italian and North African, does not meet the nutritional requirements of the organism. As can be seen from Fig. 6, the nutritional input in Malta differs to a great extent from present recommendations (16,70,52), although its fundamental composition is very similar to the nutrition in other western countries (78).

The general characteristics of the Maltese nutrition could be summed up as follows: too high an intake of refined carbohydrates, fats, and particularly cholesterol; low carbohydrate intake, particularly complex carbohydrate intake, and a very low consumption of fibre-rich foods. If we add the fact that a large number of the Maltese have excess body weight, with mostly the android type of obesity, we can easily conclude that the "nutritional risk factors" for the onset of diabetes are strongly present in the Maltese population, and that they may well present the main element in the etiopathogenesis of diabetes. If a low degree of knowledge on nutrition and an insufficient local food production are added to the above, one may conclude that the nutritional state in Malta is unsatisfactory.

6. RECOMMENDATIONS

Organization of health services

The development of health services for diabetics has been performed in parallel with the beginning of the survey. Training of the local staff for an advanced and up-to-date technology presents the main directions in this field, and are still under way. Central and peripheral diabetic clinics should operate to meet both the acute and the chronic requirements of patients.

The outpatient component should be developed both centrally, at St Luke's Diabetic Clinic, and at the peripheral clinics in Mosta, Paola and Craig Hospital. Special services should be available on request (ophthalmological, dietetic, nephrological, neurological, cardiological, etc.). These special services will also be required for inpatients.

The role of nutritional factors in the genesis of diabetes mellitus in the Maltese population points to the presence of errors in nutrition, both in relation to the kind and quantity of foods. A substantial difference between the actual nutrition in Malta and that recommended elsewhere is obvious. The level of dietary fibre is very low, whereas the intake of fats, particularly cholesterol, is disturbing. Although the metabolism of an average Maltese may have become adapted to such a diet, a high number of subjects with excessive body weight is still to be found. As a high BMI is a risk factor for many

diseases, excess body weight should be reduced. Prevention of obesity, which is accompanied by hyperinsulinaemia and may cause exhaustion of the pancreatic B-cell and the onset of diabetes, means at the same time prevention of cardiovascular diseases. The way in which it can be achieved is both complex and long-term. Nutritional habits must be changed gradually, physical activity of the Maltese should be intensified, and some traditional misconceptions should be abandoned, such as that to be fat means to be healthy. More fibre-rich food should be included in the diet.

In order to change the nutritional pattern, long-term action starting with schoolchildren should be initiated. For this purpose, nutrition of the population should be further studied in detail. Well-prepared surveys should be repeated biannually to obtain follow-up data on nutrition.

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TABLE 1. SURVEY POPULATION COMPARED WITH ESTIMATED POPULATION BY LOCALITY AND GENDER

Locality	Estimated population 1979 (%)	Survey population, 1980			
		%	No. Males	No. Females	Total
Maltese Islands	100.0	100.0			
Malta	92.7	90.0	1705	1815	3520
Gozo	7.3	10.0	185	206	391
Malta:					
Inner Harbour Region	37.0	31.4	608	622	1230
Outer Harbour Region	25.2	27.2	506	559	1065
South-Eastern Region	11.3	11.2	216	223	439
Western Region	11.5	11.9	222	244	466
Northern Region	7.6	8.2	153	167	320

TABLE 2. DISTRIBUTION OF SURVEY FAMILY MEMBERS BY AGE AND % OF TOTAL POPULATION

Age-Group (years)	Distribution (% total)		Survey population as % of total population
	Estimated population	Survey population	
0-4	9.0	6.2	0.9
5-9	7.9	7.8	1.2
10-14	7.3	7.9	1.3
15-19	9.2	9.4	1.3
20-24	9.9	9.0	1.1
25-29	8.9	6.6	0.9
30-34	9.1	8.2	1.1
35-39	5.7	7.2	1.6
40-44	5.8	5.7	1.2
45-49	5.3	6.1	1.4
50-54	5.2	6.0	1.4
55-59	4.7	6.6	1.5
60-64	3.6	4.5	1.6
65-69	3.0	3.4	1.4
70-74	2.6	3.0	1.4
75-79	1.9	2.3	1.5
80-84	0.7	1.0	1.8
85+	0.3	0.4	1.9

TABLE 3. QUALITY CONTROL DATA FOR RESULTS OF ASSAYS IN MALTA SURVEY

Assay	Units	Level	Within Assay C.V.	Between Assay C.V.
			%	%
Plasma Urea	mg/dl	46	1.8	4.8
	mg/dl	80	1.2	4.5
Plasma Urate	?mg/dl	5.6	2.0	5.1
	?mg/dl	9.4	1.4	8.0
Plasma Cholesterol	mg/dl	111	3.0	5.1
	mg/dl	270	2.9	5.2
Plasma HDL Cholesterol	mg/dl	17.0	4.5	12.7
Plasma Triglycerides	mg/dl	141	10.0	16.6
	mg/dl	227	13.5	14.6
Plasma Creatinine	mg/dl	1.8	2.5	8.1
		3.5	1.6	3.3
Glycosylated Hb	%	7.4	-	5.4
	%	10.0	-	5.2
	%	16.1	-	3.0
	%	10	3.3	-
	%	12	2.3	-
Blood Glucose	mg/dl	40	2.3	3.1
	mg/dl	90	2.1	2.8
	mg/dl	300	2.4	3.0
Plasma Insulin	µU/ml	low level	17.2	14.3%
		high level		16.1%
Plasma C-peptide	ng/ml	-	13%	17.5%

C.V.

TABLE 4. DISTRIBUTION OF SAMPLE POPULATION BY AGE, GENDER AND LOCATION

Age	Malta				Gozo				Total				Total	
	Males		Females		Males		Females		Males		Females			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
15-24	164	19.2	169	16.0	27	26.7	29	21.0	191	20.0	198	16.6	389	18.1
25-34	170	19.9	211	20.0	8	7.9	21	15.2	178	18.6	232	19.4	410	19.1
35-44	141	16.5	197	18.7	12	11.9	21	15.2	153	16.0	218	18.3	371	17.2
45-54	131	15.3	199	18.8	22	21.8	26	18.8	153	16.0	225	18.8	378	17.6
55-64	129	15.1	151	14.3	13	12.9	17	12.3	142	14.9	168	14.1	310	14.4
65-74	84	9.8	86	8.1	11	10.9	11	8.0	95	10.0	97	8.1	192	8.9
75+	35	4.1	43	4.1	8	7.9	13	9.4	43	4.5	56	4.7	99	4.6
TOTAL	854	100	1056	100	101	100	138	100	955	100	1194	100	2149	100
% TOTAL		39.7		49.1		4.7		6.4						100

TABLE 5. SAMPLE DISTRIBUTIONS OF LEVEL OF EDUCATION, MARITAL STATUS AND OCCUPATION, BY LOCATION AND GENDER (PERCENTAGE IN PARENTHESES)

Education:		No school	Primary	Secondary	Technical	Tertiary	University
Malta:	Males	78 (9.1)	322 (37.7)	228 (26.7)	121 (14.2)	56 (6.6)	49 (5.7)
	Females	125 (11.8)	589 (55.8)	255 (24.2)	14 (1.3)	59 (5.6)	14 (1.3)
Gozo:	Males	9 (8.9)	42 (41.6)	30 (29.7)	9 (8.9)	7 (6.9)	4 (4.0)
	Females	14 (10.1)	75 (54.4)	33 (23.9)	2 (1.5)	12 (8.7)	1 (0.7)

Marital status:		Single	Married	Separated	Widowed	Other
Malta:	Males	278 (32.6)	552 (64.6)	1 (0.1)	22 (2.6)	1 (0.1)
	Females	356 (33.7)	609 (57.7)	10 (1.0)	81 (7.7)	0
Gozo:	Males	43 (42.6)	52 (51.5)	0	6 (5.9)	0
	Females	70 (50.7)	62 (44.9)	0	6 (4.4)	0

Occupation:		Wage/ salary	Employer	Self-employed	Unpaid worker	Not employed	Housewife	Unknown
Malta:	Males	664 (77.8)	0	63 (7.4)	3 (0.4)	119 (13.9)	0	5 (0.6)
	Females	255 (24.2)	1 (0.1)	14 (1.3)	27 (2.6)	124 (11.7)	634 (60.0)	1 (0.1)
Gozo:	Males	59 (58.4)	0	18 (17.8)	0	15 (14.9)	0	9 (8.9)
	Females	48 (34.8)	0	2 (1.5)	2 (1.5)	27 (19.6)	59 (42.8)	0

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TABLE 6. MEAN VALUES OF HEIGHT, WEIGHT, BODY MASS INDEX (BMI) AND BLOOD PRESSURE IN SAMPLE POPULATION BY AGE-GROUP AND GENDER

Age-group (years)	Gender	No.[a]	Blood pressure		Height (cm)	Weight (kg)	BMI (kg/m^2)
			Systolic (mmHg)	Diastolic			
15-24	M	191	123.8	45.5	170.1	66.1	22.8
	F	198	117.0	75.6	157.0	56.7	23.0
25-34	M	177	126.2	77.9	167.1	73.4	25.6
	F	232	119.3	77.6	155.7	61.2	25.3
35-44	M	153	128.8	81.8	167.1	75.7	27.1
	F	218	128.1	82.3	154.6	65.9	27.6
45-54	M	153	135.8	84.8	164.5	75.3	27.8
	F	225	143.9	89.3	152.9	70.9	30.5
55-64	M	142	144.0	86.3	164.1	74.4	27.6
	F	168	153.3	93.0	151.0	71.2	31.1
65-74	M	95	153.1	88.8	164.0	71.3	26.5
	F	97	161.5	99.1	149.9	70.2	31.2
75+	M	43	155.3	87.1	160.3	82.1	26.1
	F	56	155.6	89.5	147.6	62.9	28.9
TOTAL	M	954	134.3	81.9	166.2	72.2	26.4
	F	1194	135.1	84.9	153.7	65.4	27.6

[a] One subject was excluded because height could not be measured because of bilateral amputation.

TABLE 7. MEAN BODY MASS INDEX (BMI) AND STANDARD DEVIATION (S.D.) BY AGE-GROUP, GENDER AND FINAL DIAGNOSIS. S.D. VALUES ARE NOT GIVEN FOR DIABETICS DUE TO SMALL NUMBER

Age-group (years)	NORMAL		IGT		DIABETIC			
					Newly diagnosed		Previously known	
	Male	Female	Male	Female	Male	Female	Male	Female
15-24	22.8 (3.7)	23.0 (4.4)	24.4 (10.3)	-	-	-	0	27.6
25-34	25.5 (3.9)	25.3 (4.8)	30.9 (1.8)	26.3 (6.1)	-	-	24.4	27.6
35-44	27.0 (4.2)	27.5 (5.3)	26.3 (2.8)	28.6 (4.5)	32.7	-	22.7	33.9
45-54	27.9 (4.3)	30.2 (6.1)	28.6 (5.1)	32.8 (4.7)	30.5	30.6	21.7	30.6
55-64	27.3 (4.9)	31.4 (5.1)	28.8 (5.1)	30.0 (5.0)	34.2	32.5	26.0	28.0
65-74	26.1 (3.6)	30.8 (5.7)	27.5 (4.8)	34.5 (6.8)	28.5	34.4	26.4	28.1
75+	25.6 (4.0)	28.7 (6.9)	25.8 (4.2)	29.6 (6.7)	28.7	24.7	23.1	27.9

TABLE 8. MEAN TRICEPS SKINFOLD THICKNESS, ARM CIRCUMFERENCE AND BMI (± S.D.) IN SAMPLE, INCLUDING DIABETICS AND IGT CASES

	Males	Females
Triceps skinfold thickness (mm)	10.1 ± 3.1	26.3 ± 5.3
Arm circumference (cm)	35.3 ± 9.8	33.6 ± 10.1
BMI ($^{W}/_{H^2}$ x 100) (kg/m^2)	25.6 ± 4.5	27.5 ± 6.1

TABLE 9. FREQUENCY DISTRIBUTION OF FINAL DIAGNOSIS IN THE SAMPLE POPULATION

	Number	%
Normal	1862	86.7
IGT	120	5.6
Diabetes: newly diagnosed	38	1.8
previously known	127	5.9
Unknown[a]	2	0.1

[a] Subjects did not turn up for repeat OGTT.

TABLE 10. AGE DISTRIBUTION, GENDER AND LOCATION OF SUBJECTS WITH NORMAL OGTT (% IN PARENTHESES)

Age-group (years)	Male			Female			Total
	Malta	Gozo	Total	Malta	Gozo	Total	
15-24	161 (21.4)	26 (29.2)	187 (22.3)	168 (18.6)	29 (24.0)	197 (19.3)	384 (20.4)
25-34	166 (22.4)	8 (9.0)	174 (20.7)	207 (22.9)	21 (17.4)	228 (22.3)	402 (21.6)
35-44	134 (17.8)	12 (13.5)	146 (17.4)	189 (21.0)	20 (16.5)	209 (20.5)	355 (19.1)
45-54	119 (15.8)	18 (20.2)	137 (16.3)	162 (18.1)	22 (18.2)	184 (18.0)	321 (17.2)
55-64	102 (13.6)	12 (13.5)	114 (13.6)	110 (12.2)	13 (10.7)	123 (12.0)	237 (12.7)
65-74	52 (6.9)	8 (9.0)	60 (7.1)	46 (5.1)	8 (6.6)	54 (5.3)	114 (6.1)
75+	17 (2.3)	5 (5.6)	22 (2.6)	19 (2.1)	8 (6.6)	27 (2.6)	49 (2.6)
Total	751 (100.0)	89 (100.0)	840 (100.0)	901 (100.0)	121 (100.0)	1022 (100.0)	1862 (100.0)

TABLE 11. AGE DISTRIBUTION, GENDER AND LOCATION OF SUBJECTS WITH IMPAIRED GLUCOSE TOLERANCE (IGT)

TABLE 11. AGE DISTRIBUTION, GENDER AND LOCATION OF SUBJECTS WITH IMPAIRED GLUCOSE TOLERANCE (IGT)

Age-group (years)	Malta				Gozo				Total				Total	
	M		F		M		F		M		F			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
15-24	3	6.1	0	0	0	0	0	0	3	5.4	0	0	3	2.5
25-34	2	4.1	4	7.1	0	0	0	0	2	3.6	4	6.3	6	5.0
35-44	3	6.1	6	10.7	0	0	1	12.5	3	5.4	7	10.9	10	8.3
45-54	7	14.3	15	26.8	2	28.6	1	12.5	9	16.1	16	25.0	25	20.8
55-64	12	24.5	11	19.6	1	14.3	2	25.0	13	23.2	13	20.3	26	21.7
65-74	11	22.4	10	17.9	2	28.6	1	12.5	13	23.2	11	17.2	24	20.0
75+	11	22.4	10	17.9	2	28.6	3	37.5	13	23.2	13	20.3	26	21.7
	49	100	56	100	7	100	8	100	56	100	64	100	120	100

TABLE 12. AGE DISTRIBUTION, GENDER AND LOCATION OF NEWLY DIAGNOSED AND PREVIOUSLY KNOWN DIABETICS (PERCENTAGE IN PARENTHESES)

Age-group (years)	Malta		Gozo		Total	
	Male	Female	Male	Female	Male	Female
	N %	N %	N %	N %	N %	N %
Newly diagnosed						
15-24	0	0	0	0	0	0
25-34	0	0	0	0	0	0
35-44	3 (23.0)	0	0	0	3 (20.0)	0
45-54	2 (15.4)	5 (24.8)	0	1 (50)	2 (13.3)	6 (26.1)
55-64	2 (15.4)	3 (14.3)	0	0	2 (13.3)	3 (13.0)
65-74	5 (38.5)	9 (42.9)	1 (50)	0	6 (40.0)	9 (39.2)
75+	1 (7.7)	4 (19.0)	1 (50)	1 (50)	2 (13.3)	5 (21.7)
	13 (100)	21 (100)	2 (100)	2 (100)	15 (100)	23 (100)
Previously known						
15-24	0	1 (1.3)	1 (33.3)	0	1 (2.3)	1 (1.2)
25-34	1 (2.5)	0	0	0	1 (2.3)	0
35-44	1 (2.5)	2 (2.6)	0	0	1 (2.3)	2 (2.4)
45-54	5 (13.5)	20 (25.9)	2 (66.7)	3 (42.8)	7 (16.3)	23 (27.4)
55-64	13 (32.5)	26 (33.8)	0	2 (28.6)	13 (30.2)	28 (33.3)
65-74	16 (40.0)	21 (27.3)	0	2 (28.6)	16 (37.3)	23 (27.4)
75+	4 (10.0)	7 (9.1)	0	0	4 (9.3)	7 (8.3)
	40 (100)	77 (100)	3 (100)	7 (100)	43 (100)	84 (100)

TABLE 13. IMPAIRED GLUCOSE TOLERANCE AND DIABETES (NEWLY DIAGNOSED AND PREVIOUSLY KNOWN) BY AGE-GROUP AND GENDER AS PERCENTAGE OF SAMPLE POPULATION (PERCENTAGE OF TOTAL SAMPLE IN PARENTHESES)

Age-group (years)	Diabetics				IGT	
	Newly diagnosed		Previously known			
	Male	Female	Male	Female	Male	Female
15-24	0	0	1 (0.05)	1 (0.5)	3 (0.2)	0
25-34	0	0	1 (0.05)	0	2 (0.1)	4 (0.2)
35-44	3 (0.2)	0	1 (0.05)	2 (0.9)	3 (0.2)	7 (0.3)
45-54	2 (0.1)	5 (0.2)	5 (0.3)	19 (0.8)	9 (0.6)	16 (0.7)
55-64	2 (0.1)	3 (0.2)	13 (0.9)	28 (1.7)	13 (0.9)	13 (0.8)
65-74	6 (0.6)	9 (0.9)	16 (1.7)	23 (2.4)	13 (1.4)	11 (1.1)
75+	2 (0.5)	5 (0.9)	4 (0.9)	7 (1.3)	13 (3.0)	13 (2.3)
Total	15 (1.6)	22 (2.2)	41 (4.0)	70 (8.0)	56 (4.4)	64 (5.5)

TABLE 14. DISTRIBUTION OF SUBJECTS BY GENDER, BODY MASS INDEX (BMI) AND FASTING BLOOD GLUCOSE CATEGORY, EXCLUDING PREVIOUSLY KNOWN DIABETICS (PERCENTAGE IN PARENTHESES)

BMI:	25		25-29.9		30+	
Blood glucose (mg/dl)	Male	Female	Male	Female	Male	Female
60	58 (14.5)	78 (18.7)	33 (8.8)	48 (12.7)	14 (13.6)	29 (11.1)
61- 80	252 (62.8)	261 (62.4)	227 (60.2)	233 (61.6)	45 (43.7)	127 (48.1)
81-100	78 (19.5)	66 (15.8)	90 (23.9)	78 (20.6)	25 (24.3)	80 (30.3)
101-140	8 (2.0)	8 (1.9)	16 (4.2)	14 (3.7)	10 (9.7)	19 (7.2)
121-140	5 (1.2)	2 (0.5)	5 (1.3)	1 (0.3)	5 (4.9)	3 (1.1)
141-160	0	3 (0.7)	3 (0.8)	1 (0.3)	1 (1.0)	2 (0.7)
161+	0	0	3 (0.8)	3 (0.8)	3 (2.9)	4 (1.5)
Total	401 (100)	418 (100)	377 (100)	378 (100)	103	264 (100)

In 8 subjects data for height, weight or blood glucose were missing so that these subjects were excluded from the calculations.

TABLE 15. METHOD OF TREATMENT (a) IN SUBJECTS PREVIOUSLY DIAGNOSED AS DIABETIC AND (b) IN THOSE WITH THE FINAL DIAGNOSIS OF DIABETES

	(a)				(b)			
	Males		Females		Males		Females	
	No.	%	No.	%	No.	%	No.	%
Diet only	31	43.1	56	43.8	12	27.9	18	21.4
Oral hypoglycaemic agents	33	45.8	53	41.4	24	55.8	47	56.0
Insulin	8	11.1	19	14.8	7	16.3	19	22.6
Total	72	100.0	128	100.0	43	100.0	84	100.0

TABLE 16. FINAL DIAGNOSIS OF PREVIOUSLY DIAGNOSED DIABETICS (a) AND DISTRIBUTION OF ALL FINAL DIAGNOSIS DIABETICS BY GENDER (b)

(a) Final diagnostic category of previously diagnosed diabetics (% in parentheses)			
	Males	Females	Total
Normal	16 (22.2)	31 (24.2)	47 (23.5)
IGT	13 (18.1)	13 (10.2)	26 (13.0)
Diabetic	43 (59.7)	84 (65.6)	127 (53.5)
Total	72 (100.0)	128 (100.0)	200 (100.0)
(b) Distribution of final diagnosis diabetics by gender (% of total sex-specific population in parentheses)			
Known	43 (4.5)	84 (7.0)	127 (5.9)
New	15 (1.6)	23 (1.9)	38 (1.8)
Total	58 (6.1)	107 (9.0)	165 (7.7)

TABLE 17. FASTING (a) AND TWO-HOUR (b) POST GLUCOSE LOADING URINE GLUCOSE CONTENT BY FINAL DIAGNOSIS AND GENDER
DATA EXPRESSED AS PERCENTAGE OF GROUP

Urine glucose g/100 ml	Normal		IGT		Diabetic			
					Newly diagnosed		Previously known	
	Male %	Female %	Male %	Female %	Male %	Female %	Male %	Female %
(a) Fasting								
Nil	98.8	98.8	86.5	91.7	42.9	61.9	39.5	48.0
0.25	1.0	1.0	5.8	5.0	28.6	14.3	10.5	2.7
0.5	0.1	0.1	1.9	1.7	14.3	14.3	13.2	8.2
1.0	0.1	0.1	5.8	1.6	14.2	9.5	36.8	41.1
(b) 2-hour								
Nil	72.7	83.8	25.0	31.0	7.1	4.8	7.4	8.0
0.25	13.4	7.3	21.2	13.8	7.1	23.8	0	6.0
0.5	8.0	5.4	17.3	25.9	7.1	38.1	37.0	38.0
1.0	5.9	3.5	36.5	29.3	78.7	33.3	55.6	48.0

TABLE 18. DISTRIBUTION OF SYMPTOMS BY FINAL DIAGNOSIS AND GENDER

TABLE 18. DISTRIBUTION OF SYMPTOMS BY FINAL DIAGNOSIS AND GENDER

Symptom	Normal			IGT			Diabetic			Total		
	Males	Females	Both sexes	Males	Females	Both sexes	Males	Females	Both sexes	Males	Females	Both sexes
No. in sample	840	1022	1862	56	64	120	58	107	165	954	1193	2147
Tiredness												
No. positive	68	79	147	7	10	17	9	29	38	84	118	202
% positive	8.1	7.7	7.9	12.5	15.6	14.2	15.5	27.1	23.0	8.8	9.9	9.4
Polyphagia												
No. positive	183	106	289	12	15	27	18	42	60	213	163	376
% positive	21.8	10.4	15.5	21.4	23.4	22.5	31.0	39.3	36.4	22.3	13.7	17.5
Polyuria												
No. positive	65	106	171	5	11	16	10	26	36	80	143	223
% positive	7.7	10.4	9.2	8.9	17.2	13.3	17.2	24.3	21.8	8.4	12.0	10.4

TABLE 19. TREATMENT WITH DIURETICS, HYPOTENSIVE AGENTS AND BLOOD LIPID LOWERING DRUGS BY FINAL DIAGNOSIS AND GENDER

Treatment		Normal			IGT			Diabetic			Total		
		Males	Females	Both sexes	Males	Females	Both sexes	Males	Females	Both sexes	Males	Females	Both sexes
No. in sample		840	1022	1862	56	64	120	58	107	165	954	1193	2147
No. on blood lipid lowering drugs	No.	3	3	6	-	-	-	-	6	6	3	9	12
	%	0.4	0.3	0.3					5.6	3.6	0.3	0.8	0.6
No. on diuretic agents	No.	20	52	72	8	8	16	8	19	27	36	79	115
	%	2.4	5.1	3.9	14.3	12.8	13.3	13.8	17.8	16.4	3.8	6.6	5.4
No. on hypo-tensive drugs	No.	31	69	108	8	12	20	8	21	29	47	102	149
	%	3.7	6.9	5.4	14.3	18.8	16.7	13.8	19.6	17.6	4.9	8.5	6.9

TABLE 20. DISTRIBUTION OF HYPERTENSION ACCORDING TO AGE AND BMI OF THE DIETARY SAMPLE

Age-group (years)	Sex	BMI	All	No. found hypertensive	Raised blood pressure[a] %
15-24	M	22.8	188	9	4.8
	F	23.0	200	5	2.5
25-34	M	25.9	140	8	5.7
	F	25.3	226	6	2.6
35-44	M	27.0	110	14	12.7
	F	27.6	182	25	13.7
45-54	M	27.8	114	29	25.4
	F	30.5	180	87	48.3
55-64	M	27.6	108	37	34.3
	F	31.1	148	101	68.2
65-74	M	26.5	90	42	46.7
	F	31.2	110	68	61.8
75+	M	26.5	46	24	52.2
	F	31.2	76	32	42.1
Total	M	25.6	796	163	20.5
	F	27.5	1122	324	28.9

[a] Using WHO criteria for hypertension.

TABLE 21. AGE AND SEX DISTRIBUTION OF TOTAL DIETARY SAMPLE (PHASE I)

Age-group (years)	Total dietary sample			Nutrient intake sample		
	Male	Female	Total	Male	Female	Total
20-35	328	426	754	16	24	40
36-55	224	362	586	87	88	175
56+	240	332	572	36	36	72
Total	792	1120	1912	139	148	287

TABLE 22. AGE AND SEX DISTRIBUTION OF MEAN HEIGHT AND WEIGHT, kg OVER THE STANDARD BODY WEIGHT[a] AND BODY STATUS

Age-group (years)	Sex	Height (cm)	Weight (kg)	kg over the standard weight	Body status[b]
15-24	M	170.1	65.8	+ 0.1	Normal
	F	156.9	55.8	+ 1.5	Normal
25-34	M	167.0	72.5	+ 0.9	Overweight
	F	155.7	60.3	+ 7.6	Overweight
35-44	M	167.1	74.8	+10.2	Overweight
	F	154.6	64.1	+12.9	Obesity
45-54	M	164.5	74.4	+11.2	Overweight
	F	152.9	70.1	+18.2	Obesity
55-64	M	164.1	73.5	+10.6	Overweight
	F	151.1	70.2	+19.3	Obesity
65-74	M	164.0	70.4	+ 7.5	Overweight
	F	149.9	69.2	+18.3	Obesity
75 years or more	M	160.2	65.5	+ 5.0	Overweight
	F	147.5	61.9	+13.0	Obesity
Total	M	165.3	69.9	+ 7.3	Overweight
	F	152.6	64.6	+13.6	Obesity

[a] From Metropolitan Life Insurance Co., Stat. Bull., 41, 4, 1960.

[b] Adopted from Jelliffe: The Assessment of the Nutritional Status, WHO, Geneva, 1966.

TABLE 23. PERCENTAGE OF FREQUENCY OF FOOD INTAKE

Item	More than 3 x weekly	3 x weekly and less	Never
Milk pasture	31.8	6.7	61.5
Milk tinned	87.1	4.6	8.3
Cheddar cheese	79.5	13.6	6.8
Ricotta	48.2	16.6	35.2
Meat	63.7	33.4	2.9
Poultry	60.1	24.0	15.9
Fish	45.5	26.8	27.7
Meat products	54.0	17.6	28.4
Sausages	29.5	17.7	52.8
Bacon	36.0	19.6	44.4
Ham	59.2	16.7	24.1
Egg	41.4	36.3	22.3
Butter	62.8	8.2	29.0
Margerine	24.6	7.5	67.9
Bread	98.1	0.9	1.0
Potato	69.5	23.6	6.9

Results presented as percentage of population sample.

TABLE 24. PERCENTAGE OF FREQUENCY OF FOOD INTAKE

Item	More than 3 x weekly	3 x weekly and less	Never
Spaghetti	59.8	25.7	14.5
Other pasta	52.9	25.1	22.0
Rice	50.1	33.5	16.4
Cheese-cake	41.0	26.3	32.7
Pizza	16.5	28.7	54.8
Peas	60.8	16.2	23.0
Beans	32.5	19.4	48.1
Cauliflower	72.9	14.4	12.7
Cabbage	71.1	14.9	14.0
Tomato	66.7	17.6	15.7
Carrot	59.6	12.9	27.5
Lettuce	45.0	14.3	40.7
Green paprika	27.8	11.7	60.5
Olives	47.2	16.3	36.5
Nuts	23.3	14.8	61.9
Fruit	83.5	9.5	7.0

Results presented as percentage of population sample.

TABLE 25. PERCENTAGE OF FREQUENCY OF FOOD INTAKE

Item	More than 3 x weekly	3 x weekly and less	Never
Sugar	87.3	2.6	10.1
Jam	15.3	12.0	72.7
Trifle	25.2	22.4	52.4
Cakes	46.6	29.7	23.7
Tea/coffee	87.1	4.6	8.3
Soft drinks	59.0	10.8	30.2
Wine	31.1	2.7	66.2
Beer	19.3	13.2	67.5
Whisky	18.9	17.3	63.8
Tap water	49.2	7.8	43.0
Mineral water	7.8	5.2	87.0

Results presented as percentage of population sample.

TABLE 26. FOOD INTAKE AS PERCENTAGE OF TOTAL ENERGY BY AGE AND SEX EXPRESSED AS MEAN ± SEM IN PHASE I STUDY (WINTER PHASE)

Nutrients	Age-groups (years)	Male	Female
Protein (%)	20-35	16.7 ± 2.3	16.3 ± 2.7
	36-55	16.2 ± 2.6	16.5 ± 7.3
	56+	17.2 ± 2.5	16.9 ± 2.2
	Mean	16.5 ± 2.5	16.5 ± 6.0
Total fat (%)	20-35	38.8 ± 6.3	43.6 ± 7.2
	36-55	41.6 ± 7.1	46.3 ± 8.8
	56+	43.1 ± 8.1	44.9 ± 5.6
	Mean	41.5 ± 7.3	45.5 ± 8.0
Carbohydrate (%)	20-35	44.4 ± 7.4	40.1 ± 6.8
	36-55	42.2 ± 7.3	37.3 ± 9.5
	56+	39.8 ± 9.1	38.1 ± 5.6
	Mean	41.9 ± 7.8	38.0 ± 8.5
Sugar (%)	20-35	16.4 ± 5.3	15.1 ± 5.9
	36.55	16.7 ± 5.9	15.5 ± 7.8
	56+	12.9 ± 7.5	13.0 ± 4.9
	Mean	14.6 ± 6.2	15.2 ± 6.8
Starch (%)	20-35	28.0 ± 7.5	21.8 ± 6.7
	36-55	24.1 ± 6.9	26.8 ± 8.4
	56+	27.4 ± 6.9	25.1 ± 4.7
	Mean	27.4 ± 7.2	22.8 ± 6.5

TABLE 27. DAILY FOOD INTAKES BY AGE AND SEX
EXPRESSED AS MEAN ± SEM IN PHASE I STUDY
(WINTER PHASE)

Nutrients and energy	Age-groups (years)	Male	Female
Energy (Kcal)	20-35	3780 ± 1260	2730 ± 1344
	36-55	3528 ± 1932	2856 ± 1554
	56+	3150 ± 1260	3108 ± 882
	Mean	3472 ± 1119	2785 ± 757
Energy (MJ)	20-35	9.0 ± 3.0	6.5 ± 3.2
	36-55	8.4 ± 4.6	6.8 ± 3.7
	56+	7.5 ± 3.0	7.4 ± 2.1
	Mean	8.3 ± 2.6	6.6 ± 1.9
Protein (g)	20-35	151 ± 33	113 ± 33
	36-55	139 ± 49	128 ± 47
	56+	129 ± 32	109 ± 18
	Mean	139 ± 44	122 ± 28
Total fat (g)	20-35	156 ± 42	136 ± 48
	36-55	160 ± 63	150 ± 57
	56+	143 ± 36	132 ± 35
	Mean	156 ± 56	145 ± 53
Carbohydrate (g)	20-35	403 ± 113	274 ± 76
	36-55	364 ± 135	269 ± 96
	56+	315 ± 142	250 ± 62
	Mean	359 ± 136	267 ± 87
Sugar (g)	20-35	151 ± 61	106 ± 40
	36-55	127 ± 72	114 ± 70
	56+	103 ± 80	88 ± 44
	Mean	126 ± 73	108 ± 62
Starch (g)	20-35	252 ± 86	168 ± 70
	36-55	236 ± 93	156 ± 55
	56+	212 ± 105	162 ± 35
	Mean	233 ± 97	159 ± 55
Dietary cholesterol (mg)	20-35	1352 ± 527	1058 ± 479
	36-55	1218 ± 508	1231 ± 558
	56+	1068 ± 398	907 ± 307
	Mean	1207 ± 494	1143 ± 656
Dietary fibre (g)	20-35	30.5 ± 11.6	25.2 ± 9.1
	36-55	32.0 ± 11.9	25.6 ± 9.6
	56+	30.4 ± 11.9	26.0 ± 6.7
	Mean	31.5 ± 11.8	25.6 ± 9.0
Dietary fibre (g/1000 Kcal)	20-35	8.4 ± 2.9	9.4 ± 2.8
	36-55	9.3 ± 2.8	9.1 ± 2.9
	56+	9.7 ± 2.9	10.3 ± 2.5
	Mean	9.3 ± 2.9	9.3 ± 2.8

TABLE 30. COMPARISON OF SELECTED VARIABLES BY COVARIANCE ANALYSIS IN FINAL DIAGNOSTIC GROUPS ADJUSTING FOR AGE

	Gender	Normal		IGT		Diabetic	
		$\bar{X}$	Covariance mean	$\bar{X}$	Covariance mean	$\bar{X}$	Covariance mean
Age (years)	M	39.8		55.3		58.4	
	F	39.5		54.9		58.9	
Height (cm)	M	161.6	161.5	163.2	163.7	155.6	156.3
	F	152.8	152.7	149.9	150.5	145.7	146.3
Weight (kg)	M	69.9	70.7	83.5	80.9	71.0	67.8
	F	64.1	64.6	69.8	67.2	67.1	63.7
Systolic BP (mmHg)	M	132.5	133.8	148.9	141.0	144.3	134.6
	F	132.0	133.4	150.1	142.5	155.6	145.6
Diastolic BP (mmHg)	M	81.0	81.6	87.3	83.6	87.9	83.3
	F	83.2	83.9	89.5	85.9	97.8	93.1
Fasting blood glucose (mg/dl)	M	73.9	74.1	97.3	95.9	147.5	145.8
	F	73.1	73.4	90.4	89.2	164.1	162.4
Blood glucose 2 hours after 75 g glucose (mg/dl)	M	82.8	83.6	161.7	156.9	189.6	183.7
	F	87.7	88.6	162.3	157.7	207.9	201.9
BMI (kg/m^2)	M	25.8	25.6	27.4	31.4	27.8	26.9
	F	27.3	27.2	30.9	30.6	29.3	28.8

TABLE 31. DIABETES SURVEY - PERSONS WHO DID NOT ATTEND PHASE I MALTA - GOZO

Age-group (years)	Males		Females		Total	
	Diabetic	Non-diabetic	Diabetic	Non-diabetic	Diabetic	Non-diabetic (%
15-24	-	141	-	116	-	257 (30.8)
25-34	-	89	-	82	-	171 (20.5)
35-44	-	64	1	68	1	132 (15.8)
45-54	1	48	-	46	1	94 (11.3)
55-64	2	45	2	48	4	93 (11.2)
65-74	4	24	2	26	6	50 (5.8)
75+	3	16	3	19	6	35 (4.2)
Total	10	427	8	405	18[a]	832[a]

[a] These figures represent the results of a rapid rescreening programme and may require further analysis.

TABLE 32. REVISED DIAGNOSIS IN PARTICIPANTS IN PHASE II WITH % SHOWN IN PARENTHESES

Revised diagnosis in Phase II	Final diagnosis in Phase I			Total
	Normal	IGT	Diabetes	
Normal	167 (92.3)	4 (4.8)	2 (1.5)	173
IGT	13 (7.2)	67 (80.7)	1 (0.8)	81
Diabetes	1 (0.6)	12 (14.5)	130 (97.8)	143
Total	181(100.0)	83(100.0)	133(100.0)	397

TABLE 33. MEAN BODY MASS INDEX (BMI) ACCORDING TO REVISED DIAGNOSIS AND GENDER AND ANALYSIS BY COVARIANCE (PHASE II) ADJUSTING FOR AGE

Age-group (years)	Gender	Normal	IGT	Diabetic	
		BMI	BMI	Newly diagnosed BMI	Previously known BMI
15-24	M	23.3	18.0	26.2	22.5
	F	24.5	31.6	-	22.7
25-34	M	23.9	29.1	-	24.8
	F	27.1	22.3	-	-
35-44	M	25.2	25.4	-	22.4
	F	27.0	27.1	-	34.6
45-54	M	28.0	27.1	27.1	23.8
	F	25.9	31.4	32.4	31.1
55-64	M	26.7	30.9	26.8	26.5
	F	31.5	29.9	25.4	28.3
65-74	M	24.6	27.6	25.8	26.4
	F	33.6	20.7	33.5	29.3
75+	M	24.1	24.9	23.9	27.8
	F	29.3	28.9	29.8	28.9
Covariance Mean	M	25.8	27.0		26.0[a]
	F	28.7	29.9		29.4[a]

[a] Pooled data for diabetes.

		BMI
N:I	M	1.25 n.s.
	F	1.18 n.s.
N:D	M	0.35 n.s.
	F	0.67 n.s.

TABLE 34. MEAN LEVELS OF FASTING PLASMA TRIGLYCERIDES BY REVISED DIAGNOSIS, AGE-GROUP AND GENDER, WITH ANALYSIS BY COVARIANCE, ADJUSTING FOR AGE

DATA PRESENTED AS mg/dl

Age-group (years)	Gender	Normal	IGT	Diabetic	
				Newly diagnosed	Previously known
15-24	M	102	131	-	90
	F	63	-	-	85
25-34	M	104	125	-	62
	F	100	167	-	-
35-44	M	97	85	-	190
	F	132	107	-	142
45-54	M	165	140	120	115
	F	98	110	164	136
55-64	M	138	147	-	143
	F	123	111	177	135
65-74	M	114	154	151	163
	F	126	170	-	163
75+	M	124	96	129	119
	F	156	107	113	138
Covariance Mean	M	128	138	134[a]	
	F	113	118	141[a]	

[a] Pooled data for diabetics.

N:I	M	4.34	P<0.01
	F	0.95	n.s.
N:D	M	1.25	n.s.
	F	5.21	P<0.01
I:D	M	2.50	P<0.02
	F	4.33	P<0.01

TABLE 35: MEAN LEVELS OF FASTING PLASMA CHOLESTEROL (mg/dl) BY REVISED DIAGNOSIS, AGE-GROUP AND GENDER, WITH ANALYSIS BY COVARIANCE, ADJUSTING FOR AGE

Age-group (years)	Gender	Normal	IGT	Diabetic	
				Newly diagnosed	Previously known
15-24	M	180	136	215	177
	F	178	227	-	268
25-34	M	192	257	-	195
	F	195	182	-	-
35-44	M	178	201	-	242
	F	197	220	-	268
45-54	M	236	221	220	208
	F	233	254	279	233
55-64	M	218	226	149	227
	F	232	259	254	232
65-74	M	203	207	219	216
	F	264	259	226	251
75+	M	219	184	258	189
	F	241	234	246	235
Covariance Mean	M	210	212	211[a]	
	F	218	240	243[a]	

[a] Pooled data for diabetics.

N:I	M	0.30	n.s
	F	2.42	P<0.02
N:D	M	0.19	n.s.
	F	3.18	P<0.001
I:D	M	0.14	n.s.
	F	0.27	n.s.

TABLE 36. MEAN LEVELS OF FASTING PLASMA HDL CHOLESTEROL (mg/dl) BY REVISED DIAGNOSIS, AGE-GROUP AND GENDER, WITH ANALYSIS BY COVARIANCE, ADJUSTING FOR AGE

Age-group (years)	Gender	Normal	IGT	Diabetic	
				Newly diagnosed	Previously known
15-24	M	42.0	57.0	35.0	51.0
	F	47.4	44.5	-	50.2
25-34	M	43.8	21.5	-	57.0
	F	45.9	62.0	-	-
35-44	M	44.1	41.0	-	29.5
	F	42.0	53.7	-	61.5
45-54	M	40.1	34.1	31.2	58.2
	F	52.4	59.3	50.2	47.3
55-64	M	41.9	42.2	21.3	39.7
	F	51.6	51.3	55.4	52.1
65-74	M	41.2	43.4	30.7	41.8
	F	54.0	44.3	46.4	49.3
75+	M	47.3	50.1	42.0	42.3
	F	55.8	56.0	57.0	46.7
Covariance Mean	M	41.8	41.9	40.2[a]	
	F	49.0	51.6	50.1[a]	

[a] Pooled data for diabetics.

N:I	M	0.04	n.s.
	F	0.99	n.s.
N:D	M	0.81	n.s.
	F	0.55	n.s.
I:D	M	0.66	n.s.
	F	0.63	n.s.

TABLE 37. MEAN LEVELS OF Hb $A1_c$ BY REVISED DIAGNOSIS, AGE-GROUP AND GENDER, WITH ANALYSIS BY COVARIANCE, ADJUSTING FOR AGE

Age-group (years)	Gender	Normal	IGT	Diabetic	
				Newly diagnosed	Previously known
		%	%	%	%
15-24	M	7.1	6.7	8.1	11.1
	F	6.7	7.5	-	10.4
25-34	M	6.7	7.2	-	11.0
	F	6.8	7.7	-	-
35-44	M	7.1	7.3	-	8.5
	F	6.5	7.4	-	15.1
45-54	M	7.3	7.4	8.7	9.6
	F	7.7	7.4	9.9	10.6
55-64	M	7.5	8.1	9.5	10.8
	F	7.4	7.6	10.9	10.5
65-74	M	7.5	8.0	9.7	9.9
	F	7.3	7.8	9.9	9.8
75+	M	7.4	7.5	9.0	8.9
	F	7.6	7.7	12.7	9.3
Covariance Mean	M	7.3	7.7	9.7[a]	
	F	7.3	8.1	10.4[a]	

[a] Pooled data for diabetics.

N:I	M	2.28	P<0.02
	F	1.09	n.s.
N:D	M	10.43	P<0.001
	F	12.05	P<0.001
I:D	M	7.40	P<0.001
	F	3.03	P<0.001

TABLE 38. MEAN LEVELS OF PLASMA UREA (mg/dl) BY REVISED DIAGNOSIS, AGE-GROUP AND GENDER, WITH ANALYSIS BY COVARIANCE, ADJUSTING FOR AGE

Age-group (years)	Gender	Normal	IGT	Diabetic	
				Newly diagnosed	Previously known
15-24	M	29.0	21.0	28.0	15.0
	F	17.2	24.5	-	39.5
25-34	M	28.7	26.5	-	32.0
	F	20.6	17.0	-	-
35-44	M	29.5	26.0	-	31.0
	F	31.0	29.3	-	25.0
45-54	M	25.3	29.2	48.2	29.5
	F	24.5	30.2	36.2	28.5
55-64	M	30.7	32.0	24.3	36.4
	F	25.5	29.9	26.3	32.4
65-74	M	31.0	28.8	29.1	39.1
	F	31.9	30.8	29.0	29.6
75+	M	33.8	34.9	32.0	26.8
	F	25.9	29.5	28.7	35.5
Covariance	M	29.4	29.5	33.3[a]	
Mean	F	25.1	29.5	30.2[a]	

[a] Pooled data for diabetics.

N:I	M	6.64	n.s.
	F	2.90	$P<0.02$
N:D	M	1.76	n.s.
	F	3.58	$P<0.01$
I:D	M	1.23	n.s.
	F	0.43	n.s.

TABLE 39. MEAN PLASMA CREATININE (mg/dl) BY REVISED DIAGNOSIS, AGE-GROUP AND GENDER, WITH ANALYSIS BY COVARIANCE, ADJUSTING FOR AGE

Age-group (years)	Gender	Normal	IGT	Diabetic	
				Newly diagnosed	Previously known
15-24	M	0.68	0.80	0.60	0.50
	F	0.53	0.60	-	0.73
25-34	M	0.72	0.65	-	0.70
	F	0.55	0.50	-	-
35-44	M	0.65	0.70	-	0.70
	F	0.65	0.55	-	0.60
45-54	M	0.70	0.71	1.88	0.50
	F	0.48	0.52	0.52	0.56
55-64	M	0.71	0.64	0.43	0.59
	F	0.61	0.52	0.48	0.57
65-74	M	0.84	0.66	0.77	0.82
	F	0.57	0.57	0.50	0.55
75+	M	0.73	0.81	0.80	0.63
	F	0.56	0.65	0.63	0.65
Covariance Mean	M	0.7	0.7	0.8[a]	
	F	0.6	0.6	0.6[a]	

[a] Pooled data for diabetics.

N:I	M	0.00	n.s.
	F	0.00	n.s.
N:D	M	2.37	P<0.02
	F	0.00	n.s.
I:D	M	2.26	P<0.02
	F	0.00	n.s.

TABLE 40. MEAN LEVEL OF PLASMA URIC ACID (mg/dl) BY FINAL DIAGNOSIS, AGE-GROUP AND GENDER, WITH ANALYSIS BY COVARIANCE, ADJUSTING FOR AGE

Age-group (years)	Gender	Normal	IGT	Diabetic	
				Newly diagnosed	Previously known
15-24	M	4.4	5.2	6.3	4.4
	F	4.1	5.1	-	4.9
25-34	M	5.6	6.1	-	4.2
	F	4.1	3.4	-	-
35-44	M	4.9	3.2	-	4.7
	F	3.5	5.2	-	5.7
45-54	M	5.5	5.5	6.1	4.2
	F	4.5	4.6	5.9	5.1
55-64	M	5.9	5.5	2.8	5.0
	F	4.4	4.8	5.6	5.3
65-74	M	5.5	5.2	6.3	6.1
	F	5.9	5.8	5.2	4.7
75+	M	5.4	4.7	6.1	5.6
	F	4.5	5.3	4.7	5.0
Covariance	M	5.5	5.2	5.4[a]	
Mean	F	4.6	5.0	5.0[a]	

[a] Pooled data for diabetics.

N:I	M	1.27	n.s.
	F	1.54	n.s.
N:D	M	0.43	n.s.
	F	1.84	n.s.
I:D	M	0.68	n.s.
	F	0.00	n.s.

TABLE 41. MEAN LEVELS OF FASTING PLASMA C-PEPTIDE (ng/ml) BY REVISED DIAGNOSIS, AGE-GROUP AND GENDER, WITH ANALYSIS BY COVARIANCE, ADJUSTING FOR AGE

Age-group (years)	Gender	Normal	IGT	Diabetic	
				Newly diagnosed	Previously known
15-24	M	1.2	0.6	2.0	-
	F	1.1	3.5	-	1.5
25-34	M	3.4	1.7		-
	F	0.9	3.2		-
35-44	M	0.9	0.3	-	1.5
	F	2.4	1.2	-	0.5
45-54	M	1.8	1.3	1.2	-
	F	1.4	1.2	0.8	0.8
55-64	M	2.2	1.3	0.3	0.1
	F	2.1	0.9	0.5	0.8
65-74	M	1.7	2.1	0.5	1.5
	F	1.3	3.2	0.4	1.8
75+	M	1.7	1.9	1.5	0.7
	F	1.8	2.8	1.3	1.6
Covariance Mean	M	1.3	1.1	0.7[a]	
	F	1.1	1.5	1.0[a]	

[a] Pooled data for diabetics.

N:I	M	0.90	n.s.
	F	1.23[a]	n.s.
N:D	M	4.43	P<0.01
	F	0.45	n.s.
I:D	M	1.89	n.s.
	F	1.56	n.s.

TABLE 42. MEAN LEVELS OF FASTING PLASMA INSULIN (μU/ml) BY REVISED DIAGNOSIS, AGE-GROUP AND GENDER, EXCLUDING INSULIN TREATED DIABETICS, WITH ANALYSIS BY COVARIANCE, ADJUSTING FOR AGE

Age-group (years)	Gender	Normal	IGT	Diabetic	
				Newly diagnosed	Previously known
15-24	M	45.6	10.1	64.0	-
	F	26.5	37.6	-	24.3
25-34	M	52.0	32.8	-	-
	F	26.1	37.0	-	-
35-44	M	17.8	8.6	-	25.0
	F	26.0	27.4	-	26.0
45-54	M	31.7	19.1	16.4	13.8
	F	20.8	23.6	13.8	13.8
55-64	M	32.4	26.5	23.0	13.7
	F	42.6	8.6	15.6	22.1
65-74	M	27.7	33.6	19.7	20.0
	F	22.6	36.9	16.2	25.3
75+	M	21.9	41.3	38.5	22.5
	F	22.0	34.0	33.5	23.8
Covariance Mean	M	28.8	28.5	20.4[a]	
	F	24.4	24.7	20.6[a]	

[a] Pooled data for diabetics.

N:I M 0.05 n.s
F 0.06 n.s.

N:D M 1.96 n.s.
F 0.87 n.s.

I:D M 1.55 n.s.
F 0.86 n.s.

NOSIS,

known

TABLE 43. OSCILLOGRAPHIC CATEGORIES BY REVISED DIAGNOSIS

	Oscillographic category			
	1		2	
	No.	%	No.	%
Normal	152	88.4	20	11.6
IGT	70	86.4	11	13.5
Newly diagnosed diabetic	29	69.1	13	30.9
Previously known diabetic	83	82.8	18	17.8

1 = Normal
2 = Decreased

Oscillometry was not performed in one amputee.

TABLE 44. SYSTOLIC AND DIASTOLIC BLOOD PRESSURE (mmHg) ACCORDING TO REVISED DIAGNOSIS AND GENDER AND ANALYSIS BY COVARIANCE ADJUSTED FOR AGE

Age-Group	Gender	NORMAL		IGT		Diabetic[a]			
						Newly diagnosed		Previously known	
		BP syst.	BP diast.	BP syst.	BP diast.	BP syst.	BP diast.	BP syst.	BP diast.
15-24	M	121.4	73.6	114.0	70.0	140.0	78.0	106.0	60.0
	F	128.7	79.3	105.0	109.0	-	-	148.0	82.5
25-34	M	119.0	70.7	138.0	83.0	-	-	130.0	74.0
	F	116.3	70.5	106.0	62.0	-	-	-	-
35-44	M	124.6	75.0	134.0	72.0	-	-	115.0	68.0
	F	138.0	80.0	137.7	80.7	-	-	140.0	78.0
45-54	M	137.0	81.8	140.0	81.1	139.2	80.4	124.0	72.0
	F	132.6	81.5	144.5	81.2	143.6	84.8	155.8	90.6
55-64	M	142.6	85.1	144.0	88.2	152.0	89.3	149.5	84.5
	F	145.6	88.4	154.5	91.5	144.8	83.0	153.7	84.8
65-74	M	137.5	83.2	149.1	89.5	156.0	85.0	155.5	88.5
	F	147.8	87.3	157.2	93.6	170.4	97.2	152.5	86.1
75+	M	156.6	92.8	150.9	80.3	171.0	95.0	140.0	79.0
	F	161.4	90.7	160.0	90.0	154.0	88.0	156.4	87.5
Covariance Mean	M	138.2	78.0	143.2	79.8			144.0	81.7
	F	143.4	80.8	149.7	82.9			150.5	85.7

[a] Pooled data for diabetics

	SYSTOLIC B.P	DIASTOLIC B.P
N:I	M 1.14 n.s.	M 0.74 n.s.
	F 1.34 n.s.	F 0.71 n.s.
N:D	M 1.49 n.s.	M 1.45 n.s.
	F 1.82 n.s.	F 2.05 $P < 0.05$
	M 0.17 n.s.	M 0.67 n.s.

TABLE 45. ELECTROCARDIOGRAPHIC CATEGORIES BY REVISED DIAGNOSIS AND GENDER

N:I M 1.14 n.s.
F 1.34 n.s.
N:D M 1.49 n.s.
F 1.82 n.s.

N:I M 0.74 n.s.
F 0.71 n.s.
N:D M 1.45 n.s.
F 2.05 P<0.05

TABLE 45. ELECTROCARDIOGRAPHIC CATEGORIES BY REVISED DIAGNOSIS AND GENDER

	Gender	Normal		Borderline		Abnormal		Total	
		Number	%	Number	%	Number	%	Number	%
Normal	Male	98	86.7	11	9.7	4	3.5	113	100
	Female	35	59.3	19	32.2	5	8.5	59	100
	Total	133	77.3	30	17.4	9	5.2	172	100
IGT	Male	33	86.8	5	13.2	0	0	38	100
	Female	33	78.6	6	14.3	3	7.1	42	100
	Total	66	82.5	11	13.8	3	3.8	80	100
Newly diagnosed diabetics	Male								
	Female								
	Total	23	60.5	9	23.7	6	15.8	38	100
Previously known diabetics	Male								
	Female								
	Total	64	63.4	30	29.7	8	7.9	102	100
Total	Male	166	81.4	27	13.2	11	5.4	204	100
	Female	120	63.8	53	28.2	15	8.0	188	100
	Total	286	73.0	80	20.4	26	6.6	392	100

In five subjects the ECG coding was not available.

TABLE 46. PREVALENCE (%) OF LARGE VESSEL DISEASE (LVD), HEART VASCULAR DISEASE (HVD), ANGINA PECTORIS (AP) AND POSSIBLE INFARCTION (PI) BY REVISED DIAGNOSIS AND GENDER

Revised diagnosis	Gender	LVD				HVD		AP			PI	
		1	2	3	4	1	2	1	2	3	1	2
Normal	M	83.5	0	13.0	3.5	84.3	15.7	95.7	1.7	2.6	99.1	0.9
	F	60.0	0	31.7	8.3	60.0	40.0	98.3	1.7	0	100.0	0
IGT	M	82.1	2.6	15.4	0	84.6	15.4	92.3	0	7.7	92.3	7.7
	F	74.4	0	18.6	7.0	76.7	23.3	97.7	0	2.3	95.3	4.7
Newly diagnosed diabetic	M	47.4	0	26.3	26.3	47.4	52.3	89.5	5.3	5.2	94.7	5.3
	F	73.9	0	21.7	4.4	73.9	26.1	91.3	4.4	4.3	100.0	0
Previously known diabetic	M	65.7	0	28.6	5.7	71.4	28.6	97.1	0	12.9	91.4	8.6
	F	54.5	0	36.4	9.1	54.5	45.5	92.4	14.5	3.1	95.5	4.5

LVD - 1 = NIL 2 = Stroke only 3 = Intermediate 4 = Severe
HVD - 1 = NIL 2 = Positive
AP - 1 = NIL 2 = Mild 3 = Severe
PI - 1 = NIL 2 = Possible

TABLE 47. PREVALENCE (%) OF CIGARETTE SMOKING BY REVISED DIAGNOSIS AND GENDER

Diagnostic group	Gender	1	2	3	4	5
Normal	M	27.8	23.5	18.3	16.5	12.2
	F	80.0	3.3	10.0	3.3	3.3
IGT	M	28.2	17.9	25.6	23.1	5.1
	F	95.3	2.3	2.3	0	0
Diabetic	M	33.3	22.2	22.2	11.1	11.1
	F	88.8	4.5	6.7	0	0

1 = never smoked
2 = stopped smoking
3 = 1-14 cigarettes/day
4 = 15-24 cigarettes/day
5 = 25+ cigarettes/day

TABLE 48. STANDARDIZED MULTIVARIATE LOGISTIC REGRESSION COEFFICIENTS OF ANALYTICAL VARIABLES USING MAXIMUM LIKELIHOOD METHOD

	Large vascular disease endpoints						ECG		
	Total large vascular disease			Heart vascular disease					
	Normal	IGT	DM	Normal	IGT	DM	Normal	IGT	DM
AGE	0.39[a]	0.29[a]	0.24[b]	0.37[a]	0.23[b]	0.25[b]	0.37[a]	0.30[a]	0.23[b]
BMI	0.04	0.02	0.03	0.07	0 35[a]	0.01	0.06	0.01	0.05
SYSTOLIC BP	0.24[b]	0.19[c]	0.22[b]	0.23[b]	0.23[b]	0.25[b]	0.27[b]	0.21[b]	0.25[b]
DIASTOLIC BP	0.22[b]	-0.03	0.17[c]	0.19	-0.01	0.18[c]	0.25	-0.007	0.19[c]
HYPERTENSION	0.22[b]	0.03	0.27[b]	0.23[b]	0.08	0.26[b]	0.24[b]	0.05	0.29[b]
CHOLESTERCL	-0.01	-0.01	-0.01	0.01	-0.05	0.003	-0.02	-0.05	0.01
SMOKING	-0.26[b]	-0.09	0.02	-0.27	-0.03	-0.01	-0.26	-0.06	-0.02

[a] Denotes $p \leq 0.001$

[b] Denotes $0.001 < p \leq 0.01$

[c] Denotes $0.01 < p \leq 0.05$

– Denotes 0.01 $p \leq 0.05$

TABLE 49: PREVALENCE OF EYE (a) AND KIDNEY (b) DISEASE BY DIABETIC DIAGNOSIS AND GENDER (% IN PARENTHESES)

			Diabetic										
			Normal				Newly diagnosed			Previously known			Total
			Male		Female		Male		Female	Male		Female	
EYE	(a)	Severe	1	(1.8)	-		2	(10.5)	2 (8.7)	2	(5.7)	4	(6.1)
		Medium	1	(1.8)	5	(4.6)	4	(21.1)	2 (8.7)	9	(25.7)	9	(13.6)
		Minimal	0		4	(3.7)	0		5 (21.7)	3	(8.6)	13	(19.7)
		Negative	53	(96.4)	100	(91.7)	13	(68.4)	14 (60.9)	21	(60.0)	40	(60.6)
KIDNEY	(b)	Severe	-		-		2	(10.5)	-	3	(8.1)	4	(6.3)
		Minimal	1	(1.7)	11	(10.0)	5	(26.3)	3 (14.3)	5	(13.5)	12	(18.7)
		Negative	58	(98.3)	99	(90.0)	12	(63.2)	18 (85.7)	29	(78.4)	48	(75.0)

Tests incomplete in 14 subjects for eyes and 12 for kidneys.

TABLE 50. NEUROPATHIC IMPAIRMENT IN NON-DIABETIC, IGT AND DIABETIC SUBJECTS

		Sensory neuropathic impairment				Motor impairment		Sensory-motor impairment		Autonomic impairment			Total Fi(i)
		Code 1	Code 2	Code 3	Code 4	Code 1	Code 2	Code 1	Code 2	Code 1	Code 2	Code 3	
Non-diabetic	Frequency	154	16	2	0	134	38	159	13	97	73	2	172
	P(i,J)	0.390	0.041	0.005	0.000	0.339	0.096	0.403	0.033	0.246	0.185	0.005	0.435
	P(i/J)	0.457	0.296	0.667	0.000	0.490	0.312	0.464	0.250	0.519	0.359	0.400	
	P(J/i)	0.895	0.093	0.012	0.000	0.779	0.221	0.924	0.076	0.564	0.424	0.012	
	T(i,J)	147	23.5	1.31	0.44	119	53	149	22.6	81.4	88.4	2.18	
IGT	Frequency	68	13	0	0	55	26	70	11	37	43	1	81
	P(i,J)	0.172	0.033	0.000	0.000	0.139	0.066	0.177	0.028	0.094	0.109	0.003	0.205
	P(i/J)	0.202	0.241	0.000	0.000	0.202	0.213	0.204	0.212	0.198	0.212	0.200	
	P(J/i)	0.839	0.161	0.000	0.000	0.679	0.321	0.864	0.136	0.457	0.531	0.012	
	T(i,J)	69	11.1	0.62	0.21	56	25	70	10.7	18.4	41.6	1.25	
Diabetic	Frequency	115	25	1	1	84	58	114	28	53	87	2	142
	P(i,J)	0.291	0.063	0.003	0.003	0.213	0.147	0.288	0.071	0.134	0.220	0.005	0.360
	P(i/J)	0.341	0.463	0.333	1.000	0.308	0.475	0.332	0.539	0.283	0.428	0.400	
	P(J/i)	0.810	0.176	0.007	0.007	0.592	0.409	0.803	0.197	0.373	0.613	0.014	
	T(i,J)	121	19.4	1.08	0.36	98	44	123	18.7	67.2	73.0	1.80	

TABLE 50. NEUROPATHIC IMPAIRMENT IN NON-DIABETIC, IGT AND DIABETIC SUBJECTS (continued)

	Sensory neuropathic impairment				Motoric neuropathic impairment		Senso-motoric neuropathic impairment		Vegetative impairment			Total Fi(i)
	Code 1	Code 2	Code 3	Code 4	Code 1	Code 2	Code 1	Code 2	Code 1	Code 2	Code 3	
Total	337	54	3	1	273	122	343	52	187	203	5	395
Fi(J)	0.853	0.137	0.008	0.003	0.621	0.309	0.868	0.132	0.473	0.519	0.013	
x^2		5.407			12.88		10.08			11.49		
DF					2		2			4		
PR x^2/DF		0.067			0.0016		0.0065			0.0215		

Code 1 = Nil

Code 2 = Suspected impairment

Code 3 = Mild impairment

Code 4 = Expressed impairment

P(i,J) = Frequency: total number

P(i/J) = Frequency: total number of certain code

P(J/i) = Frequency: total number of certain diagnoses

T(i/J) = Expected number in certain diagnosis

Fi(i) = Total number

Fi(J) = % of total

PR x^2/DF = Probability

DF = Degrees of freedom

TABLE 51. CORRELATION OF LABORATORY AND ANTHROPOMETRIC FINDINGS

	Serum urea	Serum creatinine	Plasma C-peptide	Uric acid	Serum insulin	Age	BMI
Height	-.0330	.0405	-.0223	.751	-.0031	-.2919	-.3366
Weight	-.0188	.0718	.1227	.2415	.0574	-.0335	.7685
Systolic BP	.1083	-.0058	-.0367	.1553	-.0013	.4720	.3225
Diastolic BP	.4514	-.0120	-.0129	.2368	-.0230	.3823	.2851
Fasting BG	.1460	-.1572	-.0778	.0563	.0396	.1050	.1713
2 hour BG	.1808	-.1059	-.0818	.0754	-.0352	.2678	.1684
Tot. chol.	.1827	-.0575	.0444	.2019	.0119	.1860	.2251
Triglyceride	.0130	.0239	.1416	.1384	.0710	.1182	.1938
HDL chol.	-.0423	-.2146	-.1066	-.1017	-.0909	.0481	.0325
HbA_{1c}	.0849	-.1731	-.1123	.0185	.0368	.1655	.1320
Urea	1.0000	.2547	.0564	.2459	-.0255	.2593	.0073
Creatinine	.2547	1.0000	.2383	.1826	.0866	.1532	-.1485
C-peptide	.0564	.2383	1.0000	.1300	.4886	.1168	.1330
Uric acid	.2450	.1826	.1300	1.0000	.0776	.1622	.1869
Insulin	-.0255	.0866	.4886	.0776	1.0000	-.0603	.0555
Age	.2593	.1532	.1168	.1622	-.0603	1.0000	.1509
BMI	.0073	-.1485	.1330	.1869	.0555	.1509	1.0000

TABLE 52. FOOD INTAKE AS PERCENTAGE OF TOTAL CALORIES BY AGE AND SEX EXPRESSED AS MEAN ± SEM IN PHASE II STUDY (SUMMER PHASE)

Nutrients	Age-group (years)	Male	Female
Protein (%)	20-35	14.8 ± 2.5	16.8 ± 3.7
	36-55	16.4 ± 2.8	15.0 ± 10.1
	56+	14.9 ± 3.9	16.7 ± 5.4
	Mean	16.4 ± 3.4	17.2 ± 7.4
Total fat (%)	20-35	43.4 ± 5.9	48.9 ± 8.9
	36-55	44.7 ± 7.4	50.3 ± 7.8
	56+	47.5 ± 8.1	48.9 ± 9.8
	Mean	46.2 ± 7.7	49.9 ± 8.9
Carbohydrate (%)	20-35	41.8 ± 5.6	36.1 ± 7.6
	36-55	38.9 ± 7.6	31.9 ± 8.8
	56+	35.9 ± 9.9	33.1 ± 9.1
	Mean	37.5 ± 9.1	32.8 ± 9.2
Sugar (%)	20-35	18.9 ± 7.5	16.8 ± 7.8
	36-55	15.5 ± 5.4	13.3 ± 5.6
	56+	14.2 ± 7.6	14.0 ± 6.6
	Mean	15.4 ± 6.9	13.9 ± 6.3
Starch (%)	20-35	22.4 ± 5.1	18.9 ± 6.7
	36-55	23.1 ± 6.7	18.3 ± 7.2
	56+	20.9 ± 7.1	18.4 ± 7.8
	Mean	21.7 ± 6.8	18.4 ± 7.6

TABLE 53. DAILY FOOD INTAKES BY AGE AND SEX EXPRESSED AS MEAN ± SEM IN PHASE II STUDY (SUMMER PHASE)

Energy and nutrients	Age-group (years)	Male	Female
Energy (MJ)	20-35	9.1 ± 4.3	5.7 ± 2.2
	36-55	7.7 ± 4.3	5.1 ± 2.8
	56+	6.7 ± 4.2	4.9 ± 2.8
	Mean	7.3 ± 2.7	5.0 ± 1.6
Energy (Kcal)	20-35	3822 ± 1806	2394 ± 924
	36-55	3234 ± 1817	2142 ± 924
	56+	2814 ± 1764	2058 ± 924
	Mean	3044 ± 1130	2101 ± 665
Protein (g)	20-35	144 ± 51	91 ± 37
	36-55	128 ± 47	88 ± 29
	56+	113 ± 44	144 ± 88
	Mean	121 ± 46	113 ± 84
Total fat (g)	20-35	183 ± 51	128 ± 33
	36-55	150 ± 44	120 ± 40
	56+	142 ± 49	113 ± 37
	Mean	149 ± 49	117 ± 58
Carbohydrate (g)	20-35	407 ± 157	217 ± 88
	36-55	314 ± 137	175 ± 85
	56+	260 ± 144	178 ± 82
	Mean	293 ± 149	181 ± 84
Sugar (g)	20-35	188 ± 114	101 ± 56
	36-55	126 ± 71	72 ± 42
	56+	107 ± 77	77 ± 53
	Mean	122 ± 83	77 ± 49
Starch (g)	20-35	215 ± 73	115 ± 67
	36-55	185 ± 87	102 ± 58
	56+	150 ± 81	98 ± 47
	Mean	168 ± 90	101 ± 54
Dietary cholesterol (mg)	20-35	1430 ± 612	953 ± 369
	36-55	1045 ± 435	880 ± 353
	56+	945 ± 394	894 ± 554
	Mean	1029 ± 455	893 ± 355
Dietary fibre (g)	20-35	28 ± 10	21 ± 8
	36-55	30 ± 14	20 ± 9
	56+	26 ± 17	19 ± 8
	Mean	28 ± 15	19 ± 8
Dietary fibre (g/1000 Kcal)	20-35	7.5 ± 2.5	8.9 ± 2.9
	36-55	9.3 ± 3.1	9.3 ± 2.9
	56+	9.1 ± 3.6	9.5 ± 3.3
	Mean	8.9 ± 3.4	9.3 ± 3.0

TABLE 54. CHARACTERISTICS OF NON-RESPONDERS IN PHASE II BY AGE, GENDER, FINAL DIAGNOSES AND BMI

Age-group (years)	Gender	IGT[a]		New diabetics[b]		Previously known diabetics	
		N	BMI	N	BMI	N	BMI
15-24	M	2	27.8	0	-	0	-
	F	0	-	0	-	0	-
25-34	M	0	-	0	-	0	-
	F	2	26.0	0	-	0	-
35-44	M	1	23.6	1	45.2	1	22.7
	F	1	34.2	0	-	0	0
45-54	M	1	27.3	0	-	0	-
	F	2	26.0	2	31.6	1	30.7
55-64	M	5	26.9	1	36.0	2	27.2
	F	5	28.7	0	-	8	30.4
65-74	M	2	26.9	2	28.2	3	24.0
	F	2	35.2	3	32.8	5	28.2
75+	M	2	26.5	0	-	0	-
	F	6	27.5	1	?	0	-

[a] Full data not available for 6 IGT non-responders.

[b] Full data not available for 2 diabetic non-responders.

FIG. 1. NATIONAL DIABETES PROGRAMME MALTA

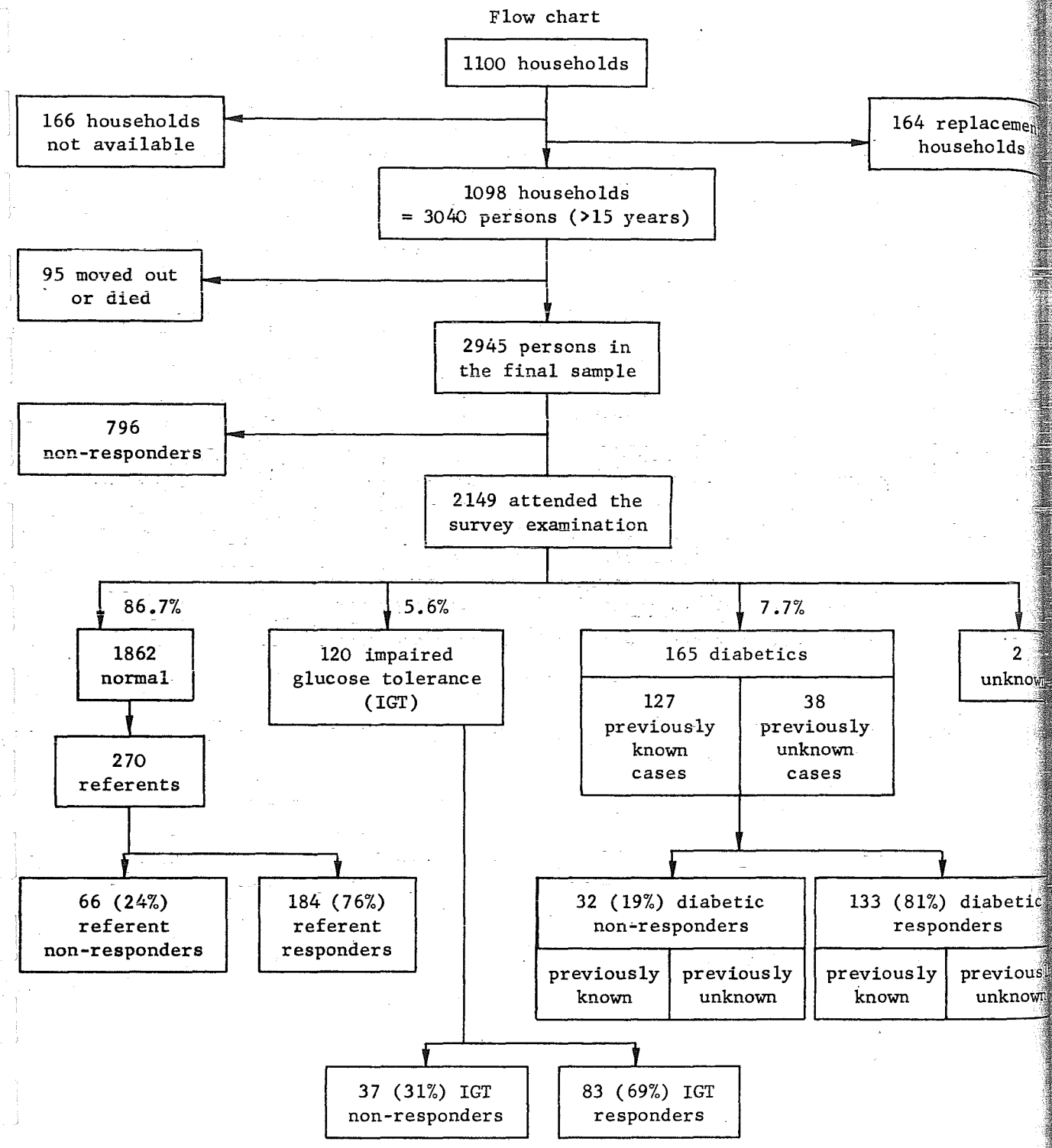


FIG. 2. AGE AND SEX DISTRIBUTION OF FASTING AND 2 HOUR POST GLUCOSE LOAD BLOOD GLUCOSE VALUES (mg/dl)

FIG. 2. AGE AND SEX DISTRIBUTION OF FASTING AND 2 HOUR POST GLUCOSE LOAD BLOOD GLUCOSE VALUES (mg/dl)

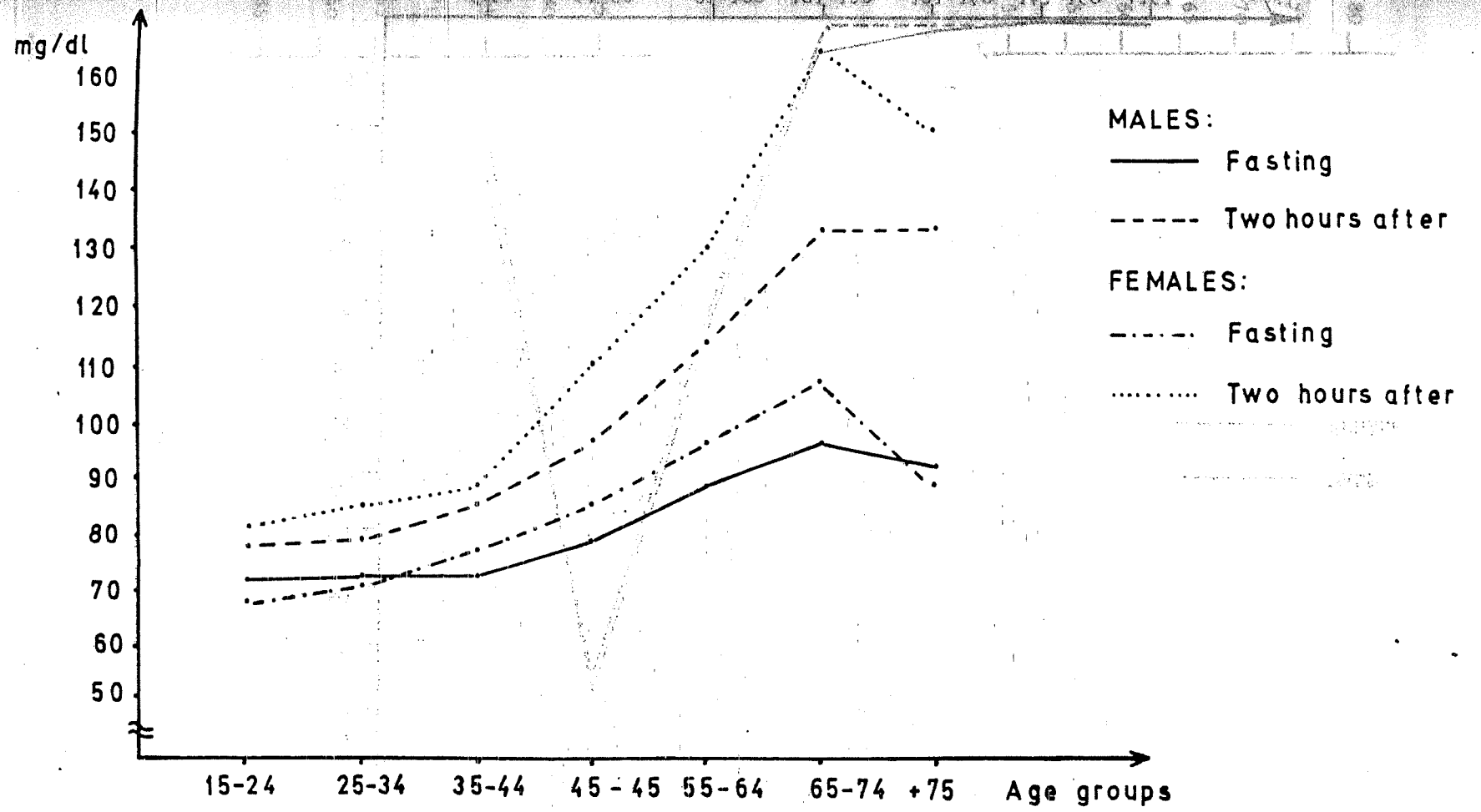


FIG. 3. FREQUENCY DISTRIBUTION OF FASTING BLOOD GLUCOSE (mg/dl) IN TOTAL SAMPLE MINUS KNOWN DIABETICS

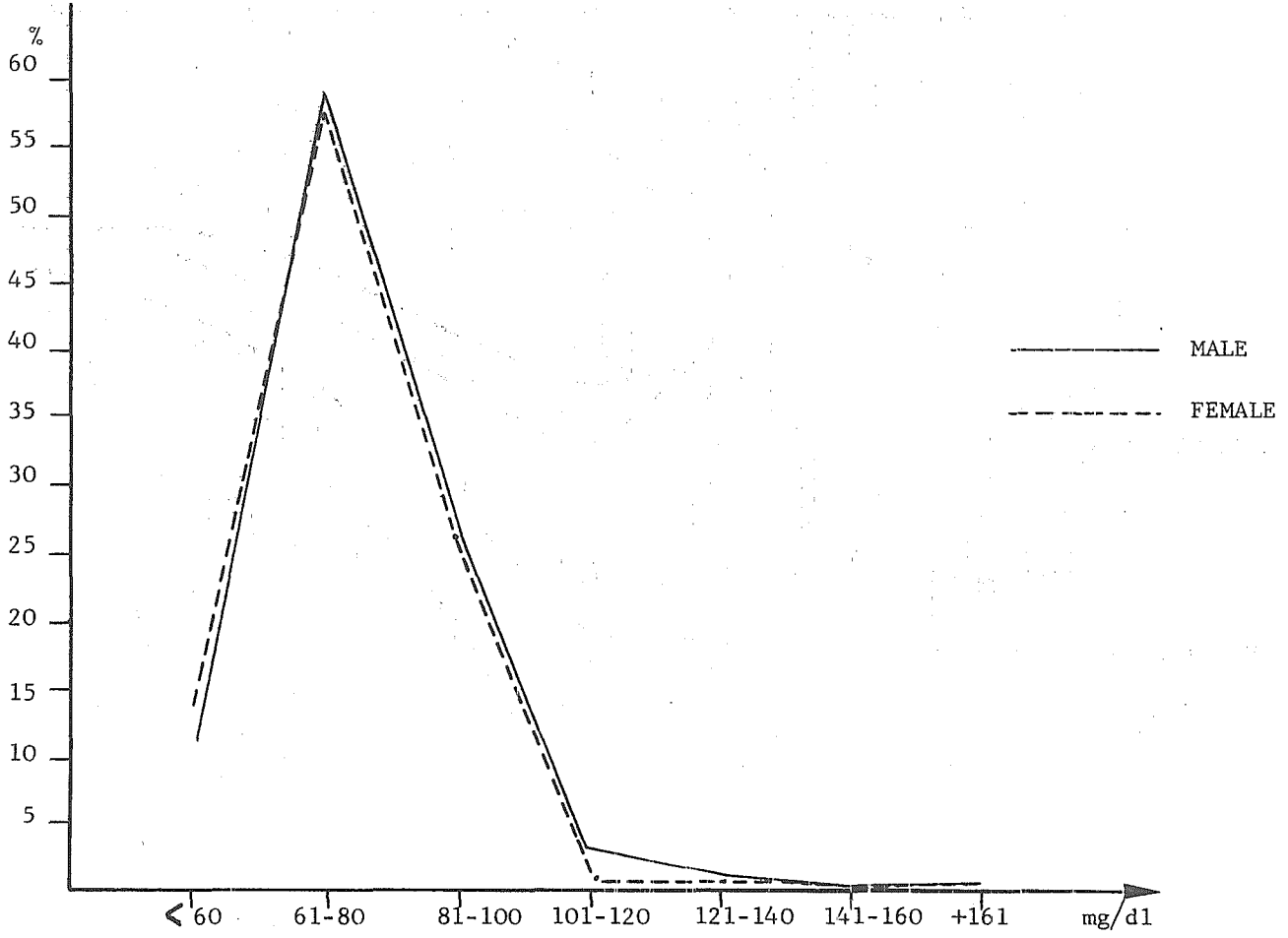


FIG. 4. DIFFERENCES BETWEEN IDEAL (STANDARD) BODY WEIGHT AND ACTUAL BODY WEIGHT FOR ACTUAL MEAN HEIGHT FEMALES
(total dietary sample)

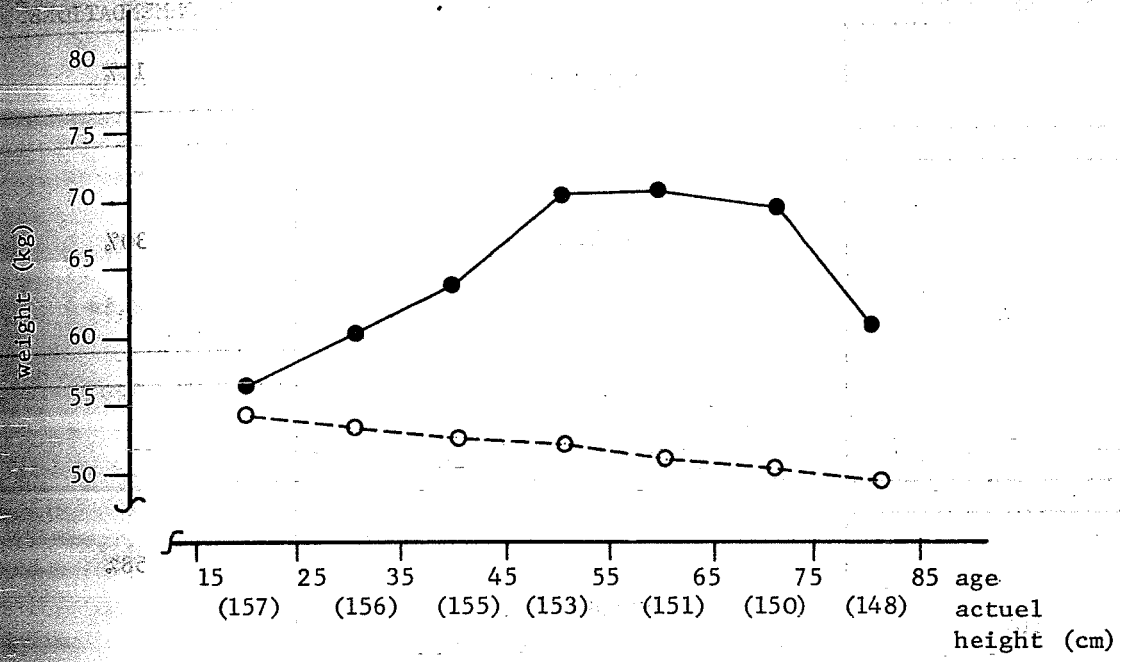


FIG. 5. ACTUAL AND IDEAL BODY WEIGHT REGARDING AVERAGE HEIGHT FOR MALES
(total dietary sample)

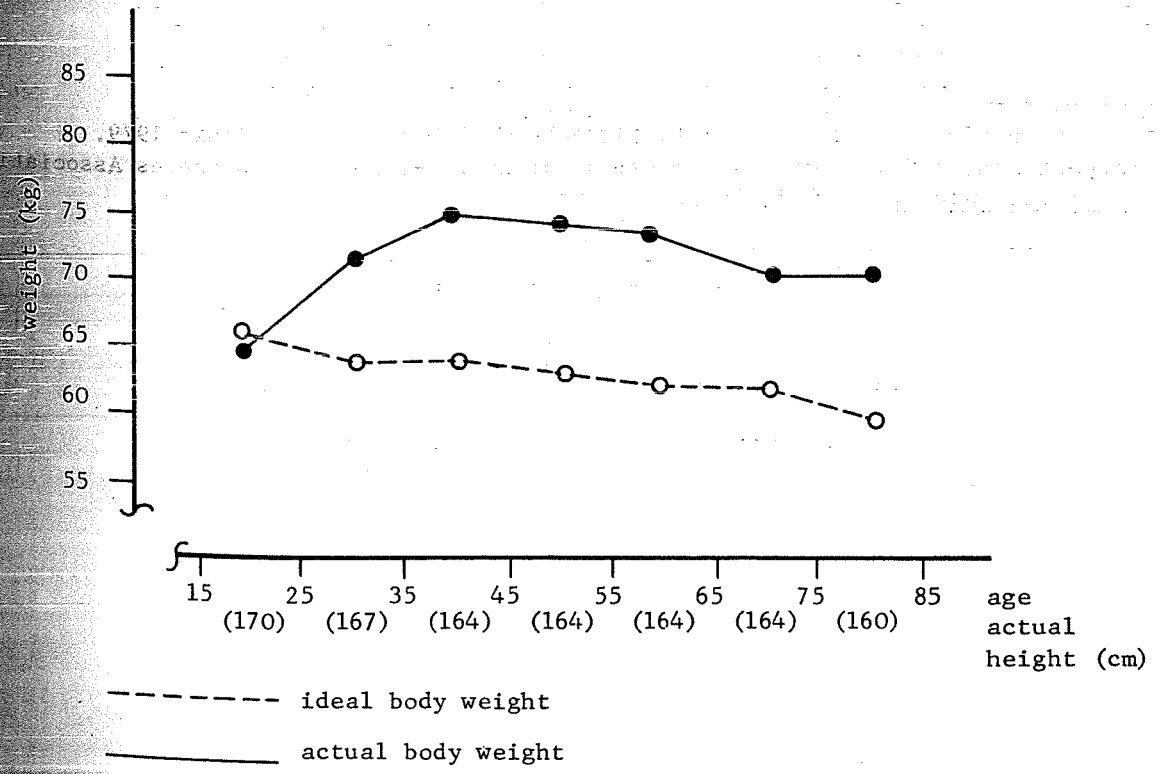
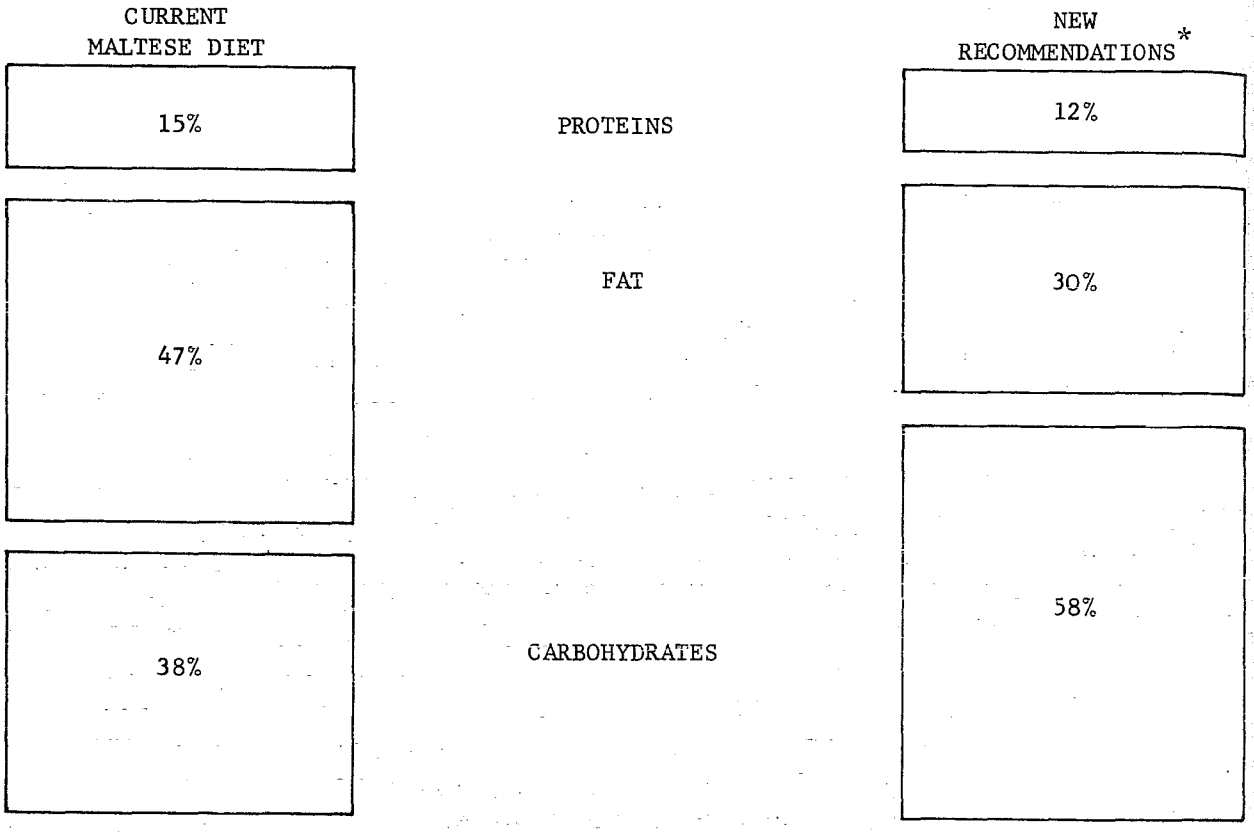
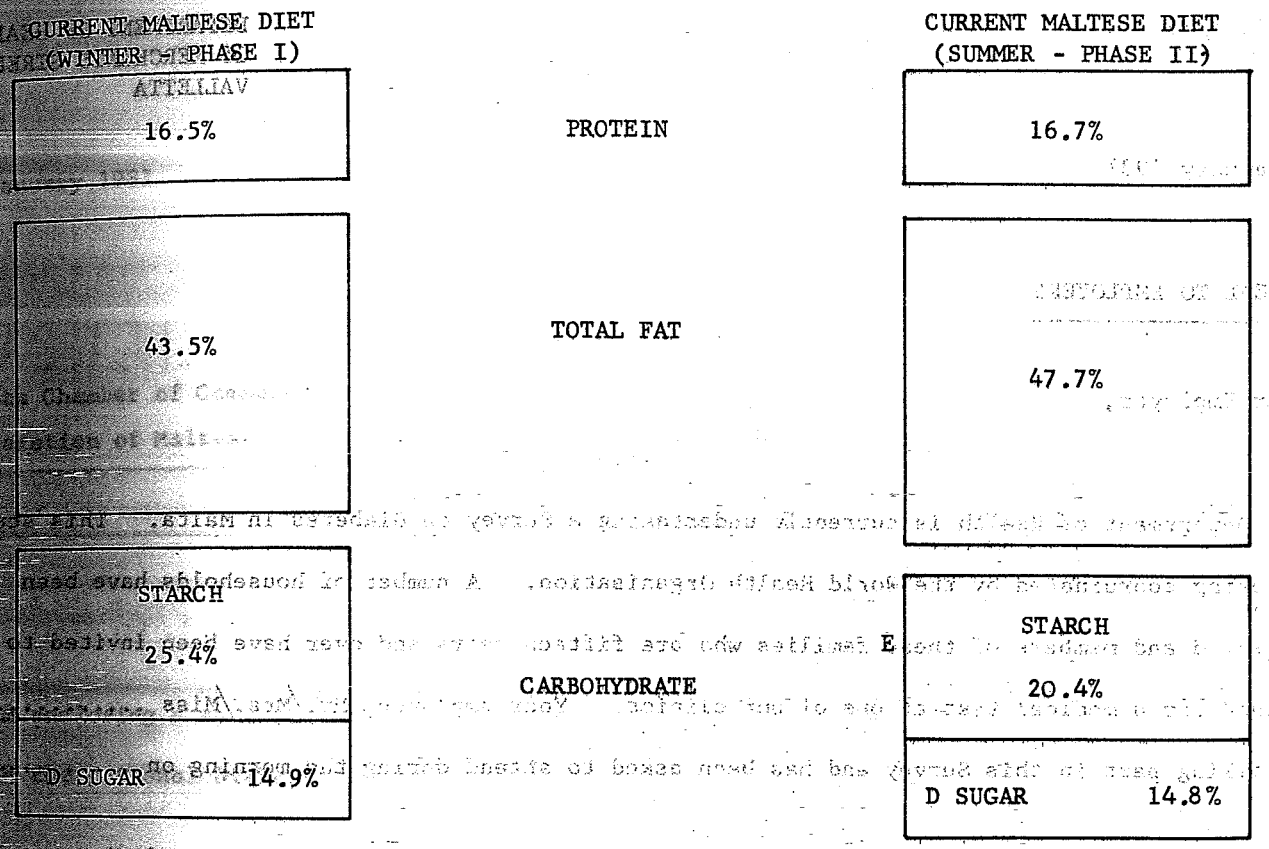


FIG. 6. MEAN VALUES OF THE ACTUAL MALTESE DIET (PHASE II RESULTS) COMPARED TO THE RECOMMENDED ONES



* Dietary Recommendation for Individuals with Diabetes Mellitus, 1979. Summary of Report from Food and Nutrition Committee of American Diabetes Association. Am. J. Clin. Nutr. 33: 1311, 1980.

FIG. 7. DIFFERENCES BETWEEN THE NUTRIENT INTAKE IN PHASE I AND PHASE II OF THE NUTRITIONAL INVESTIGATION



APPENDIX 1

DH 1471/79

DEPARTMENT OF HEALTH
15 MERCHANTS STREET
VALLETTA

9 January 1981

APPEAL TO EMPLOYERS

Dear Employer,

The Department of Health is currently undertaking a Survey on Diabetes in Malta. This study is being coordinated by the World Health Organisation. A number of households have been selected and members of these families who are fifteen years and over have been invited to attend for a medical test at one of our clinics. Your employee, Mr./Mrs./Miss ..... is taking part in this Survey and has been asked to attend during the morning on .....

I am appealing for your cooperation and contribution to the success of this study in a problem of national importance by affording the fullest facilities for your employee to attend for the medical test.

I thank you in advance for your cooperation.

Yours sincerely,

(signed)

Alf. Grech
Chief Government Medical Officer

APPENDIX 2

9 January 1981

Malta Chamber of Commerce

Federation of Maltese Industries

I am enclosing a specimen copy of an appeal which is being sent to employers in connection with the national Diabetes Survey.

I would appreciate your cooperation in encouraging your members to afford the fullest facilities to employees participating in the Survey.

Thank you.

Alf. Grech
Chief Government Medical Officer

APPENDIX 3

Phase I - January-March 19

DEPARTMENT OF HEALTH & ENVIRONMENT

NATIONAL DIABETES PROGRAMME IN MALTA

Epidemiological Survey

Initial Screening Record Form

Malta proper 1
Gozo 2

☐ 1

Subje

Subject Number ☐☐☐☐ 2-5

1.

Family Name .....

All Forenames .....

Please complete in pencil.
You are asked to insert the appropriate number in a box. To facilitate the coding and to avoid error, please make the figures easily readable. Also for "one" write 1, for "four" write 4, for "seven" write 7.

Basic Data

1. Date of birth — Day ☐☐ 6-7 Month ☐☐ 8-9 Year 19☐☐ 10-1 2.

2. Date of examination — Day ☐☐ 12-13 Month ☐☐ 14-15 Year 19☐☐ 16-1 3.

3. Sex: 1 = male 2 = female ☐ 18

4. Marital Status
1 = single 2 = married 3 = divorced
4 = widowed 5 = other 9 = unknown ☐ 19 4.

5. If married is/was husband/wife a relative?
1 = yes 2 = no 9 = unknown ☐ 20

6. If yes, he/she was a cousin of
1 = first grade 2 = second grade
3 = third grade 9 = unknown ☐ 21 5.

7. Education
1 = no school 2 = primary 3 = secondary
4 = technical school 5 = tertiary
6 = university 9 = unknown ☐ 22 6.

8. Occupation
1 = wage/salary earner 2 = employer
3 = self employed 4 = unpaid worker
5 = unemployed 6 = housewife ☐ 23 7.

APPENDIX 4a

DEPARTMENT OF HEALTH AND ENVIRONMENT

NATIONAL DIABETES PROGRAMME IN MALTA

SECOND PHASE - RESCREENING - MAY-JULY 1981

1 = Malta
2 = Gozo ☐ 1

Subject's Name ..... Subject No. ☐☐☐☐ 2-5

1. Examination Date: day ☐☐ 6-7 month ☐☐ 8-9 year ☐☐ 10-11

Previous classification:

1 = known diabetic
2 = newly diagnosed
3 = IGT
4 = control ☐ 12

General Information

Subject's:-

2. Date of Birth day ☐☐ 13-14 month ☐☐ 15-16 year ☐☐ 17-18

3. Marital Status (at present)

1 = single
2 = married
3 = separated
4 = divorced
5 = widowed
6 = no answer ☐ 19

4. Educational Level

1 = no school
2 = elementary school
3 = secondary school
4 = special technical education
5 = tertiary
6 = college/university
7 = post-graduate study ☐ 20

5. Occupation like in Screening Records ☐ 21

6. Diagnosis

1 = normal
2 = IGT
3 = diabetes ☐ 22

7. Diagnosed in ☐☐

8. Therapy

1 = diet only
2 = oral drugs
3 = insulin

☐ 25

9. Is the subject receiving oral antidiabetic drugs?

1 = sulfonylureas
2 = biguanides
3 = both
4 = neither

☐ 26

10. Is the subject receiving the following types of drugs?

1 = yes
2 = no
3 = unknown

Oral diuretics ☐ 27

Oral combined contraceptives or other oestrogens ☐ 28

Cortisone or related steroids ☐ 29

Blood lipid lowering drugs ☐ 30

Blood pressure lowering drugs (other than oral diuretics) ☐ 31

Prescribed ..... Card No. ☐☐☐☐ 32-35

Interview - ask questions directly of patient

11. "Have you ever had any pain or discomfort in your chest?"

1 = yes
2 = no
3 = unknown

☐ 36

(a) If NO, "have you ever had any pressure or heaviness in your chest?"

1 = yes
2 = no
3 = unknown

☐ 37

If NO, proceed to question 13.

(b) "Do you get it when you walk uphill or hurry?"

1 = yes
2 = no
3 = never hurry or walk uphill

☐ 38

If NO, proceed to question 12.

Appendix 4a

(c) "Do you get it when you walk at an ordinary pace on the level?"

1 = yes
2 = no

☐ 39

(d) "What do you do if you get it while you are walking?"

1 = stop or slow down
2 = carry on

☐ 40

(Record "stop or slow down" if subject carries on after taking nitroglycerine)

If CARRY ON, proceed to next question.

(e) "If you stand still, what happens to it?"

1 = relieved
2 = not relieved

☐ 41

If NOT RELIEVED, proceed to question 12.

(f) "How soon?"

1 = 10 minutes or less
2 = more than 10 minutes

☐ 42

If MORE THAN 10 MINUTES, proceed to question 12.

(g) "Will you show me where it was?"
Put code

1 = yes
2 = no

In each box.

Sternum (upper or middle) ☐ 43

Sternum (lower) ☐ 44

Left anterior chest ☐ 45

Left arm ☐ 46

Other ☐ 47

(h) "Do you feel it anywhere else?"

1 = yes
2 = no

☐ 48

If YES, record additional information above.

(i) "Did you see a doctor because of this pain (or discomfort)?"

1 = yes
2 = no

☐ 49

If YES, "what did he say it was?"

.....

12. "Have you ever had a severe pain across the front of your chest lasting for half an hour or more?"

1 = yes
2 = no

☐ 50

If YES, ask:

"Did you see a doctor because of this pain?"

1 = yes
2 = no

☐ 51

If YES, "What did he say it was?"

.....

13. (a) "Do you get pain in either leg on walking?"

1 = yes
2 = no

☐ 52

If NO, proceed to next question.

(b) "Does this pain ever begin when you are standing still or sitting?"

1 = yes
2 = no

☐ 53

If YES, proceed to next question.

(c) "In what part of your leg do you feel it?"

1 = pain includes calf/calves
2 = pain does not include calf/calves

☐ 54

If calves not mentioned, ask "anywhere else?"

If PAIN DOES NOT INCLUDE CALF/CALVES, proceed to next question.

(d) "Do you get it if you walk uphill or hurry?"

1 = yes
2 = no
3 = never hurry or walk uphill

☐ 55

(e) "Do you get it if you walk at an ordinary pace on the level?"

1 = yes
2 = no

☐ 56

(f) "Does the pain ever disappear while you are walking?"

1 = yes
2 = no

☐ 57

If YES, proceed to next question.

(g) "What do you do if you get it when you are walking?"

1 = stop or slow down
2 = carry on ☐ 58

If CARRY ON, proceed to next question.

(h) "What happens to it if you stand still?"

1 = relieved
2 = not relieved ☐ 59

(i) "How soon?"

1 = 10 minutes or less
2 = more than 10 minutes ☐ 60

14. "Have you ever had a stroke?"

1 = yes
2 = no ☐ 61

If NO, "Have you ever had weakness or loss of strength in an arm or leg lasting for 24 hours or more?"

1 = yes
2 = no ☐ 62

15. (a) "Do you smoke cigarettes now?"

1 = yes, regularly
2 = yes, occasionally (less than one per day)
3 = no ☐ 63

If NO, proceed to next question.

(b) "Do you inhale?"

1 = yes
2 = no ☐ 64

(c) "How many cigarettes do you usually smoke per day? ☐☐ 65-66

(d) "How many cigarettes did you smoke per day a year ago?" ☐☐ 67-68

(e) "How old were you when you began to smoke regularly? Age in years ☐☐ 69-70

After asking this question proceed to:

16. (a) "Did you ever smoke cigarettes?"

1 = yes, regularly
2 = yes, occasionally
3 = no, never ☐ 71

If NO, proceed to next question.

(b) "What is the maximum number of cigarettes you ever smoked per day for as long as a year?" ☐☐ 72-73

(c) "How old were you when you first began to smoke regularly?" Age in years ☐☐ 74-75

(d) "How old were you when you stopped smoking Age in years ☐☐

APPENDIX 4b

DEPARTMENT OF HEALTH AND ENVIRONMENT

NATIONAL DIABETES PROGRAMME IN MALTA

SECOND PHASE - RESCREENING - MAY-JULY 1981

1 = Malta
2 = Gozo ☐ 1

Subject's Name ..... Subject No. ☐☐☐☐ 2-5

17. Oedema of Legs

Have you ever had swelling of ankles or legs?

1 = yes, when getting up in the morning
2 = yes, but only the second half of the day
3 = no, never ☐ 6

If YES, when did you get it first time? ☐☐☐ months ago 7-9

when did you get it last time? ☐☐☐ months ago 10-12

18. Dyspnoea

(a) Are you troubled by shortness of breath when hurrying on level ground or walking up a slight hill?

1 = yes
2 = no ☐ 13

If NO, stop here.
If YES, proceed to next question.

At which stair flight does it appear when you go upstairs? ☐☐ stair flight 14-15

(b) Do you get short of breath walking with other people of your own age on level ground?

1 = yes
2 = no ☐ 16

If NO, stop here.
If YES, proceed to next question.

(c) Are you short of breath on washing and dressing?

1 = yes
2 = no ☐ 17

Appendix 4b

19. Physical activity

Work

How many hours do you spend in a normal working day at:

sitting ☐☐ hours/day 18-19

standing ☐☐ hours/day 20-21

moving about ☐☐ hours/day 22-23

carrying load ☐☐ hours/day 24-25

20. Communication with work

How many minutes a day do you normally spend going to and from work by:

bicycle ☐☐ minutes/day 26-27

walking ☐☐ minutes/day 28-29

public transport ☐☐ minutes/day 30-31

car ☐☐ minutes/day 32-33

21. Leisure

How many hours a week of your leisure time do you spend at:

	Winter	Summer
walking	☐☐ hours/week 34-35	☐☐ hours/week 36-37
Moderate or heavy physical activity (e.g. running, skiing, working in the garden, lifting heavy objects)	☐☐ hours/week 38-39	☐☐ hours/week 40-41

22. Alcohol

(a) Do you take alcoholic drinks?

1 = no, never
2 = not now, did previously (one year or more ago)
3 = yes, occasionally
4 = [illegible]

☐ 42

(b) How often do you drink?

1 = once a year
2 = once a month
3 = once a week
4 = several times a week but not daily
5 = daily

☐ 43

26.

(c) What do you normally drink?

1 = beer only
2 = wine only
3 = spirits only
4 = beer/wine
5 = beer/spirits
6 = wine/spirits
7 = beer/wine/spirits

☐ 44

27.

(d) How much do you usually drink of:

28.

		on one occasion	daily
Beer:	1 = no beer 2 = up to one litre 3 = more than one litre	☐ 45	☐ 46
*Wine:	1 = no wine 2 = up to 1/2 litre 3 = 1/2 litre but less than one litre 4 = more than one litre	☐ 47	☐ 48
**Spirits:	1 = no spirit 2 = up to 100 cc 3 = more than 100 cc (one drink = 40 cc)	☐ 49	☐ 50

* Red and white wine, sherry, vermouth, etc.

** Whisky, gin, vodka, cognac, liqueur.

Examination

23. Blood pressure : mmHg (sitting)

Systolic ☐☐☐ 51-53

Diastolic 1 ☐☐☐ 54-56

Diastolic 2 ☐☐☐ 57-59

24. Standing height (without shoes) cm ☐☐☐ 60-62

25. Weight (without shoes and coat/jacket) kg ☐☐☐ 63-65

Appendix 4b

26. Heart and lungs

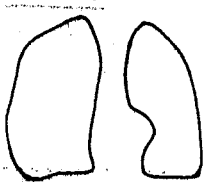
0 = nil abn.
1 = any abn.

☐ 66

Describe abns

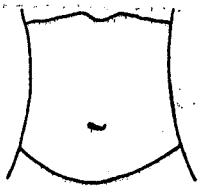
? C.C.F.

? Oedema



27. Abdomen

0 = nil abn.
1 = any abn.



☐ 67

Describe abns

28. Vascular status legs

R L

Amputation

0 = nil
1 = toe or foot
2 = above

☐☐ 68-69

Skin ischaemia

0 = nil
1 = ischaemic appearance
2 = sepsis/ulcer now
3 = past sepsis/ulcer

☐☐ 70-71

Dorsalis pedis

1 = present
2 = absent
3 = ?

☐☐ 72-73

Post tibialis

1 = present
2 = absent
3 = ?

☐☐ 74-75

Popliteals

1 = present
2 = absent
3 = ?

☐☐ 76-77

Femorals

1 = present
2 = absent
3 = ?

☐☐ 78-79

Additional comment .....

.....

.....

APPENDIX 4c

DEPARTMENT OF HEALTH AND ENVIRONMENT

NATIONAL DIABETES PROGRAMME IN MALTA

SECOND PHASE - RESCREENING - MAY-JULY 1981

1 = Malta
2 = Gozo [ ] 1

Subject's Name ..... Subject No. [ ][ ][ ][ ] 2-5

Vascular status legs (Contd.) [ ][ ] 6-7

Arterial bruits

0 = nil
1 = present [ ] 8

Where .....

29. Other Examination Findings

0 = normal
1 = abnormal

Endocrine [ ] 9

Renal [ ] 10

Musculo-skeletal [ ] 11

Skin [ ] 12

Other (specify) .....

.....

Additional comment

0 = no
1 = yes [ ] 13

(Expansion of abnormalities)

30. Fundus Examination

Is pupillary dilatation 3 mm or more?

1 = yes
2 = no

Right Eye	Left Eye
[ ] 14	[ ] 15

Is retinal detail easily visible?

1 = yes
2 = no

[ ] 16	[ ] 17

Appendix 4c

If NO, it is because of

1 = poor pupillary dilatation
2 = lens opacity
3 = vitreous opacity/haemorrhage
4 = combination of 2 and 3
5 = corneal opacity
6 = glaucoma
7 = eye absent
8 = other

	Right Eye	Left Eye
	☐ 18	☐ 19

Is lens present?

1 = yes
2 = no

	☐ 20	☐ 21

Small red lesions

1 = none
2 = one
3 = two to five
4 = six or more

	☐ 22	☐ 23

Medium red lesions

1 = none
2 = one
3 = two to five
4 = six or more

	☐ 24	☐ 25

Large red lesions

1 = none
2 = one
3 = two to five
4 = six or more

	☐ 26	☐ 27

Exudates (a) hard

1 = none
2 = one
3 = two to five
4 = six or more

	☐ 28	☐ 29

(b) soft

1 = none
2 = one
3 = two to five
4 = six or more

	☐ 30	☐ 31

New vessel systems

1 = none
2 = doubtful
3 = definite

	☐ 32	☐ 33

Additional comment by ophthalmologist

Fundus Photo No. ☐☐☐☐ 34-37

Appendix 4c

1 = Malta
2 = Gozo ☐ 1

I.

Subject's Name ..... Subject No. ☐☐☐☐ 2-5

1. Visual acuity -

	R	L	
Without glasses	☐	☐	6-7
With glasses	☐	☐	8-9

2. Tonometry ☐☐ 10-11

3. Outer segment

(a) Xanthelasma: 1 = no, 2 = yes ☐☐ 12-13

(b) Areus senilis: 1 = no, 2 = yes ☐☐ 14-15

(c) Pupils' form: 1 = unequal, 2 = equal ☐ 16

(d) Reaction: 1 = no, 2 = yes ☐☐ 17-18

(e) Cornea: 1 = cloudy, 2 = clear ☐☐ 19-20

II.

(f) Cataract: 1 = no, 2 = yes ☐☐ 21-22

(g) Glaucoma: 1 = no, 2 = yes ☐☐ 23-24

4. Card No. ☐ 80

Appendix 4c

NEUROLOGICAL HISTORY AND EXAMINATION

I. Family history

(a) Mental diseases

1 = no
2 = yes

☐ 38

(b) Epilepsy

1 = no
2 = yes

☐ 39

(c) Tuberculosis

1 = no
2 = yes

☐ 40

(d) Apoplexy

1 = no
2 = yes

☐ 41

(e) Diabetes

1 = no
2 = yes

☐ 42

(f) Alcoholism

1 = no
2 = yes

☐ 43

II. Personal history

(a) Central and peripheral nervous system diseases

1 = no
2 = yes

☐ 44

(b) Lesions of head in childhood and later age

1 = no
2 = yes

☐ 45

(c) When the first disturbances suspect on diabetes occurred?

1 = no
2 = yes

☐☐ 46-47

(d) What are these disturbances? .....

.....

Data related to neurological symptoms and psychic disturbances?

(a) Did you suffer from painful convulsions in muscles, particularly during the night?

1 = no
2 = yes

☐ 48

Appendix 4c

(b) Did you have a tingling pins-and-needles sensation or stinging feeling in legs, arms or any other side of the body during a longer or shorter period of time

1 = no
2 = yes

☐ 49

(c) Did you feel or do you feel pains in muscles either spontaneously or by pressure?

1 = no
2 = yes

☐ 50

(d) Did you have or do you have a feeling of weakness in legs, or a feeling of instability when walking?

1 = no
2 = yes

☐ 51

(e) Did you have or do you have a feeling of intensified weariness?

1 = no
2 = yes

☐ 52

(f) Did you notice a sort of weakness or shrivelling in particular of extreme parts of the body (hands, fingers)

1 = no
2 = yes

☐ 53

(g) Do you sweat excessively? Are your hands and feet markedly cold?

1 = no
2 = yes

☐ 54

(h) Did you feel faintness or dizziness from time to time?

1 = no
2 = yes

☐ 55

(i) Do you suffer from any urination disturbances?

1 = no
2 = yes

☐ 56

(j) Do you suffer from nocturnal diarrhoea?

1 = no
2 = yes

☐ 57

(k) Have you any sexual disturbances?

1 = no
2 = yes

☐ 58

Appendix 4c

(l) Psychic disturbances:

Restlessness

1 = no
2 = yes ☐ 59

Fear

1 = no
2 = yes ☐ 60

Insomnia

1 = no
2 = yes ☐ 61

Excited states

1 = no
2 = yes ☐ 62

Concentration and memorizing disturbances

1 = no
2 = yes ☐ 63

Hallucinations

1 = no
2 = yes ☐ 64

Memory disturbances

1 = no
2 = yes ☐ 65

(m) Have you ever felt temporary paralysis, palsy in one half of the body?

1 = no
2 = yes ☐ 66

(n) Have you ever lost consciousness, suddenly and unexpectedly?

1 = no
2 = yes ☐ 67

(o) Have you ever had any abrupt and unexpected speech disturbances?

1 = no
2 = yes ☐ 68

Diabetes therapy: .....

.....

Appendix 4c

Therapy of complications or other diseases: .....

.....

.....

.....

.....

Cranium and spine

1. Brain nerves

	Right	Left
Pupils: identical 1 = no 2 = yes	☐ 69	☐ 70
reaction to light 1 = no 2 = yes	☐ 71	☐ 72
accommodation 1 = no 2 = yes	☐ 73	☐ 74
consensual reaction 1 = no 2 = yes	☐ 75	☐ 76

N. Occulomotor - N. Abducent - N. Facial - N. Stat-Accoustic

1 = no

If yes: 2 = facial assymetry
3 = diplopia
4 = strabismus (squint)
5 = ptosis
6 = nystagmus ☐ 77

Card No. [3] 80

APPENDIX 4d

DEPARTMENT OF HEALTH AND ENVIRONMENT

NATIONAL DIABETES PROGRAMME IN MALTA

SECOND PHASE - RESCREENING - MAY-JULY 1981

1 = Malta
2 = Gozo ☐ 1

Subject's Name ..... Subject No. ☐☐☐☐ 2-5

Neurological Examination (Contd.)

I. Motility of trunk and extremities

1 = no
2 = yes

Movement of head and neck ☐ 6

	R	L
Radial Reflex	☐ 7	☐ 8
Extremities	☐ 9	☐ 10
Corneal Reflex	☐ 11	☐ 12

Coordination, standing and walking ☐ 13

Hypokinesis ☐ 14

Hyperkinesis ☐ 15

Paralyses (paresis)

1 = no
2 = yes

	R	L
In the area of upper extremities	☐ 16	☐ 17
In the area of lower extremities	☐ 18	☐ 19
In the area of neck and trunk	☐ 20	☐ 21

Appendix 4d

Muscles (atrophies)

1 = no
2 = yes

Upper ☐ 22

Lower ☐ 23

Reflexes: - not proved = 1; + present = 2;
+- impaired = 3; ++ increased = 4;
+++ clonus = 5

	R	L
Biceps	☐ 24	☐ 25
Triceps	☐ 26	☐ 27
Patellar	☐ 28	☐ 29
RAT	☐ 30	☐ 31
Babinski	☐ 32	☐ 33
Abdominal: upper	☐ 34	☐ 35
middle	☐ 36	☐ 37
lower	☐ 38	☐ 39
Plantar	☐ 40	☐ 41
Rossolimo s r	☐ 42	☐ 43

Sensibility

1 = decreased
2 = normal
3 = increased

Sense of touch ☐ 44

Sense of pain ☐ 45

Appendix 4d

Sense of warm and cold ☐ 46

Sense of vibration ☐ 47

Sense of position ☐ 48

Dysesthesias ☐ 49

Autonomous nervous system disturbance

1 = no
2 = yes

(Perspiration, dermographism) ☐ 50

Trophic changes ☐ 51

Contractures ☐ 52

Speech:

1 = no

If yes: 2 = dysarthria
3 = motoric aphasia
4 = dyslalia
5 = and others ☐ 53

Conclusion, diagnosis and therapy .....

.....

.....

.....

Physician's signature

Specialist in neurology

.....

Appendix 4d

Laboratory findings

OGTT blood glucose fasting ☐☐☐ 54-56

two hours after 75 g glucose ☐☐☐ 57-59

Repeated OGTT ☐☐☐ 60-62

Urine fasting: glucose ☐ 66

ketones ☐ 67

proteins ☐ 68

blood ☐ 69

two hours after 75 g glucose: glucose ☐ 70

ketones ☐ 71

Blood

Total cholesterol ☐☐☐ 72-74

Triglycerides ☐☐☐ 75-77

HDL cholesterol ☐☐ 78-79

Card No. [4] 80

APPENDIX 4e

DEPARTMENT OF HEALTH AND ENVIRONMENT

NATIONAL DIABETES PROGRAMME IN MALTA

SECOND PHASE - RESCREENING - MAY-JULY 1981

1 = Malta
2 = Gozo ☐ 1

Subject's Name ..... Subject No. ☐☐☐☐ 2-5

Laboratory Findings (Contd.)

Lipoprotein/Fredrickson ☐ 6

1 = Normal
2 = IIA
3 = IIB
4 = III
5 = IV
6 = V

Haemoglobin total ☐☐ 7-8

Hb A_1C ☐☐ 9-10

Urea ☐☐ 11-12

Creatinine ☐☐ 13-14

24 hr. proteinuria (optional) ☐☐☐☐ 15-18

Uric acid ☐☐ 19-20

Blood Group ☐ 21

A = 1
B = 2
AB = 3
O = 4

Rhesus factor ☐ 22

1 = +
2 = -

Insulin ☐☐☐ 23-25

Appendix 4e

C-peptid [ ][ ][ ] 26-28

NSS - code [ ][ ][ ] 29-31

Oscillogr. R L

1 = normal
2 = decreased oscillogr. values [ ] 32 [ ] 33

Diagnosis

1 = normal
2 = IGT,
3 = diabetes [ ] 34

with:

1 = no other findings
2 = other pathological findings
3 = ophthalmic, non diabetic [ ] 35
4 = retinopathy grade I
5 = retinopathy grade II
6 = retinopathy grade III R [ ] 36 L [ ] 37
7 = retinopathy grade IV

Cardiac non diabetic = 1
presumably diabetic = 2
mixed = 3 [ ] 38

Peripheral vascular non diabetic R L

1 = lower
2 = upper [ ] 39 [ ] 40

Peripheral vascular diabetic

1 = lower
2 = upper [ ] 41 [ ] 42

Peripheral vascular mixed

1 = lower
2 = upper [ ] 43 [ ] 44

Renal non diabetic = 1
Renal diabetic = 2 [ ] 45

1 = Neurological vascular
2 = N. toxic
3 = N. diabetic sensorial
4 = N. motoric
5 = N. autonomic [ ] 46

Appendix 4e

Further treatment

1 = drugs
2 = physical
3 = hospital

☐ 47

Next check-up

years ☐ 48

Card No.

5 80

HLA:

A

☐☐ ☐☐

B

☐☐ ☐☐

C

☐☐ ☐☐

APPENDIX 5

DIETARY HISTORY METHOD

NATIONAL DIABETES PROGRAMME IN MALTA
QUESTIONNAIRE ON THE NUTRITIONAL AND PHYSICAL ACTIVITY HABITS OF THE MALTESE POPULATION

The aim of the investigation is to improve the national habits of the population with regard to an increasing number of various diseases caused by inappropriate nutrition (obesity, diabetes, cardiovascular disease, etc.). Confidentiality is being guaranteed for all the data you provide in this pool. In order to learn as much as possible about your habits and possibilities we will make use of data on food intake (consumption) and your physical activity during the last 24 HOURS.
Please complete in pencil.

1 = Mosta
2 = Floriana
3 = Paola
4 = Gozo

Subject Number

Surname ..... All forenames .....

1. Basic Data

Day Month Year
Date of birth 19

2. Place of birth .....

3. Sex: 1 = male
2 = female

4. Marital Status: 1 = single
2 = married 3 = separated
4 = widowed 5 = other

5. Complete schooling: 1 = No school
2 = Primary school 3 = Technical school 4 = Secondary school
5 = Tertiary 6 = University

6. If employed, Where? .....
(Kind of work)

7. Distance (in km) between your working place and home

8. Since when employed in that place?

9. Type of occupational working load:
1 = light 2 = moderate 3 = heavy
4 = very heavy

10. Examinations:

Height (in cm)
Weight (in kg)

Blood pressure:
Systolic (mmHg)
Diastolic (mmHg)

Skinfold: Triceps mean (mm)
Circumference:

Blood
Fasting plasma glucose-mg/dl
2 hour plasma glucose-mg/dl
Haemoglobin g/dl
%

Urine Test:
Fasting: Glucose
Acetone
Protein
Blood
1 = none; 2 = (+); 3 = (++);
4 = (+++)

2 Hours after 75% glucose
Glucose
Acetone

Subject classification:
1 = Diabetic 2 = IGT 3 = Normal

GENERAL FORMAT FOR 24-HOUR DIETARY RECALL DATA COLLECTION

Reg. No. |_|_|_|_|

Time Hr Min.	A-am P-pm	Place 1-home 2-away	Week-day - W Sunday - S	Foods and beverages	Amount	Fat added Y-yes N-no	Duration (min.) Type of activity		Complete description of food and physical activity	Food code	Frequency Whole	Frequency Decimal	Food unit	Prep code	Fat code
05 35	P	1	W	Fried chicken	2 ps	Y	-	-	ONO 24-another 36 model	367	1	50	g	F31	+Corn
				w/skin			-	-	Fried in corn oil	017	00	25	g		Corn
				cabbage, ckd	1/2 cup	Y	-	-	Seasoned with margarine	163	0	50	cup	V40	Marg.
				Biscuit, home-made	one	Y	-	-	2" diam-"REA"	476	1	00	sv	C17	+Corn
				Made with pudding			-	-	Model No. 06						
				Corn oil and egg			-	-	Corn oil	017	1	00	TB		Corn
				Choc frosting			-	-	Medium egg	006	0	70	g		Chol
				Coca-cola	one	N	-	-	Out of tin		2	00	g	Fact	
06 45	P	2	W	-	-	-	Walking	30	Very fast carrying heavy bag (14 kg/min.)						
07 05	P	2	W	Tot of whisky	tot	N	-	-	45% whisky	216	0	30	g	-	-

APPENDIX 7

NATIONAL DIABETES PROGRAMME IN MALTA

Final report

3. Heavy metals investigations (P. Bruaux, M.D.)

INTRODUCTION

Heavy metals, and in particular cadmium and lead are potentially nephrotic and, therefore, exposure to these metals could potentiate the renal complications of diabetes mellitus. For this reason and to be complete, the determination of blood cadmium (CdB) and blood lead (PbB) concentrations were also performed, among other parameters. We expected to get a good "control group", Malta being a small island without important non-ferrous metal industries.

METHODS

Heavy metals analysis

- Blood samples were taken on E.D.T.A. in propylene tubes checked for contamination by heavy metals.
- Blood lead (PbB) analyses were performed by atomic absorption spectrophotometry, electrothermal atomization (AASETA), Fernandez method (1) modified (standard curve in blood).
- Blood cadmium (CdB) analyses were also performed by AASETA Stoeppler and Brandt method (2) slightly modified.
- For both metals, a Perkin Elmer model 5000 atomic absorption spectrophotometer equipped with an HGA 500 graphite furnace, an AS 1 auto-sampler and a deuterium arc background corrector was used for all absorption measurements which were recorded on a Perkin Elmer model 56 and printed on a Perkin Elmer model PRS 10.
- All the samples were analysed together with samples of a WHO-UNEP programme on biological monitoring for heavy metals exposure. This survey was implemented with a rigid quality control programme (QC) including preanalytical QC, internal and external QC samples (3).

This part of the survey was done by the Belgian team:

P. Bruaux, F. Claeys, G. Ducoffre, Institute of Hygiene and Epidemiology, Brussels; Director: Professor Dr A. Lafontaine.

RESULTS

Surprisingly, high levels of PbB were found which largely exceed the reference values proposed in a Directive of the European Community: "Council Directive of 29 March 1977 on Biological Screening of the Population for Lead".

These reference values (in µg per litre) for the 50th, 90th and 98th percentiles (median P50, P90 and P98) and values found in the Maltese population (538 samples) are shown below:

	P50	P90	P98
CEC max. reference values	200	300	350
Maltese population	274	450	564

These values are even higher than those observed in an area of Belgium where a lead risk from hydric origin exists and where a few clinical cases of lead intoxication are regularly found.

DISCUSSION

At this time we have no definite explanation for this relatively high exposure of the Maltese population but only a few tentative hypotheses which must be further investigated.

Besides occupational or industrial exposure, the main source of lead intake is food. So far, only a very few preliminary lead analyses have been made on environmental samples. In food samples (water, wine, flour, pasta) elevated lead concentrations. An interesting finding is the relatively high lead concentration in street dust: about 10 times higher than dust in a non-contaminated area of Belgium; the climate of Malta being dry and windy it is possible that dust contaminates food during preparation of meals.

Another hypothesis is the lead content of paints used for home decoration and for fishing ships. Regulation of the heavy metal content of paints has existed in Malta only since the beginning of 1981. We have now checked the 70 most elevated individual results in January and July 1982. They show a tendency towards lower values. In June the means of these 70 PbB results were 450 µg/l, 392 in January/P82 and 375 in July 1982. This tendency might be partially due to the regulation on paints. Air pollution via leaded gasoline must also be considered.

The results also show an increased exposure to cadmium. There is a good correlation between PbB and CdB in the Maltese population; this might indicate a common origin of exposure to both metals.

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