CISM INTERNATIONAL SYMPOSIUM
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Some possibilities of Application of New Diagnostics System Under Czech Military Conditions

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Preliminary

Together with an increasing role of the physical fitness of soldiers new possibilities of the diagnostics of actual health state have arised. Since CASRI (Czech Army Sports Research Institute) deals with the top-level army sportsmen for almost twenty years at the field of biochemistry, anthropology, psychology and physiology we felt substantially qualified to develop diagnostical system called WELLNESS CENTRE. The idea why the decision was made, came from the needs of acquiring proper and exact information on the actual heath state of soldiers working under extreme conditions, where unpredictable complications may appear be cause of insufficient personal capabilities. Czech republic belongs among countries with the shortest period of life and with highest mortality rate on account of cardiovascular diseases (48 %) and tumours (almost 25 %). Every second person has some sort of headache of back pain caused by muscular imbalances pass back bone. There are two principal reasons for it. Improper nutrition habits and lack of reasonable motion activity.

From the methodological point of view system is based on complex diagnostics which is followed by recommendations how to improve the most risky parameters. The whole diagnostical system was built up as a multi-level examination. That means, every part of the examination procedure has more then one level of testing. Every next level requires better trained staff, takes more time to proceed, but offers more detail information on patient's status.

The system is aimed to the diagnostics of health state and subsequent recommendations of training loads based upon results of diagnostics. That way every single person who was examined knows what he/she should take special care of and furthermore how to do it. During the last year system was verified by more then 800 patients and contemporary is being used at the military airport basis by pilots and their operational support (grounded and flying) on a regular basis. For example every pilot has to pass complex examination ones a year. Besides this he is supposed to pass shorten examination three times a year. And additionally, when some findings are discovered he might be tested even at the shorter period of time.

1. System introductory

1.1. Let me introduce you the diagnostical system created at our workplace. Its history began approximately three years ago. We called it WELLNESS CENTRE.

WELLNESS CENTRE was created to fulfil a few needs.

1.1.1. At first, we were looking for simple - but still effective - way of screening health state of soldiers, in order to avoid later serious diseases, which may appear due to omission of preventive care.

1.1.2. The second need concerns objectivity of data collection and its subsequent elaboration. To meet this need WELLNESS CENTRE was arrange into software package. Thus data are evaluated directly by computer and no additional commentary is required.

1.1.3. The next reason is helping people to get informed about their real stage, giving them recommendations how to improve their actual health state and when some serious health risk was discovered advising them to the special medical care. We suppose that information offered on daily basis may help keep motivation of patients throughout whole year.

1.1.4. Since the system is computerized maximum simplification of process was emphasised in order to help an operator with its use.

1.1.5. The system is not aimed only to diagnostics. Diagnostics essentially must be followed by the preparation of optimal exercise program for clients, in order to ensure proper and the most effective workout. This software helps to create an exercise program so as to avoid a danger of damaging client's health state because of inappropriate execution of exercise program.

1.1.6. The last but not least reason why we created this program was to facilitate a storage of the data about client's health state and physical condition as well as a saving of the basic personal data. And that way decrease amount of a necessary administration.

1.2. Now I would like to explain the main philosophy of the software.

WELLNESS CENTRE contents of four principal modules : personal database, diagnostics, model programs of motion activity and nutrition (see scheme no. 1).
Every module - besides personal database - is able to work separately. But, on the other hand, their co-operation to each other is possible and maximum comfort offers only their mutual cooperation. For example, data acquired at diagnostics are usable for creation of so call FITOGRAMS (that means fitness programmes). Furthermore this data can be used for nutrition recommendations, etc. The whole program was designed to be simple to use - maximum user friendly.

Let's have a brief look to every module.

1.2.1. Every exercise program as well as every recommendation has to be executed individually. That means for every particular client. Therefore we created PERSONAL DATABASE which contains basic personal data on client.

1.2.2. Maximum information about client's health state has to be obtained in order to provide the optimal exercise for every single client. This is the only way how to preserve client against injuries, non-reversible damages of motion apparatus or other fatalities. To ensure this DIAGNOSTICAL MODULE was created. This module constitutes a key-stone of the whole software.

The diagnostical module has a few planes of processing. The first one serves to collection of basic personal data (for example age, sex, inheritable presumptions, smoking, type of occupation, injuries, etc.) These questions may be answered by questionnaire. Next level represents measurement of anthropometrical parameters (body weight and height, skin folds, segment perimeters), muscle imbalances, motion test, basic psychological tests, and some more. The last level acquire more time and means to carry out the testing, but offers more detail information about health state (biochemical parameters and physiological parameters). If some findings requiring attention appears they are emphasised.

1.2.3. The next module MODEL PROGRAMS OF MOTION ACTIVITY allow to create so call fitograms. The fitograms represent written form of recommendations of optimal exercise program based on results of diagnostics (age, sex, body composition, state of cardiovascular system, main goal of exercising, etc.)

These fitograms was divided into two groups.

The AEROBIC FITOGRAMS are the first group. The aerobic fitograms serve for creation of endurance workout. This module is based on a permanent control of burnt-out energy with comparison to amount of energy gained by food. This module contains package of the most widely provided aerobic exercises. This module may be used for body weight reduction exercise programs as well as for a prevention of cardiovascular diseases.

The STRENGTH FITOGRAMS are the second group. STRENGTH FITOGRAMS are used for creation of exercise programs aimed to developing muscle strength, providing body forming and body building and mainly removing muscle imbalances. A package of strength exercises stretching exercises was added into this module.

1.2.4. Wrong nutrition habits are cause of many health problems, because of our software contains NUTRITION MODULE. This module is able to give the nutrition recommendations based on both energetic balance and balance of resources. Energetic balance means amount of energy taken from a food contrary to amount of energy burnt out during a day. Balance of resources represents balance of carbohydrates, fat, proteins, vitamins, minerals and trace elements. This module is closely linked to the aerobic workout module.

2. Methods of results

Operation of the WELLNESS CENTRE was verified by more then 800 male patients. Soldiers working under higher influence of stress creates approximately 80 % of them (pilots, airport technical staff, high-rank officers from ministry of defence, etc.). These people were chosen because there is a higher presumption of possible damage of the health state at these groups due to either stress or/and immobility. The age of tested people ranks from 20 to 55 years.

More than 60 miscellaneous parameters were observed till now. Since some parameters are supposed to be highly influenced by increasing age, following parameters were chosen for closer interpretation at this speech.

Body weight is parameter, which can be simply acquired. Body weight alone, however, cannot differentiate between amount of body fat and amount of muscles. Graph no. 1 shows that the body weight tends to increase steadily throughout the whole measured range. An average body height was 176 cm. The body weight above 75 kg is considered to be excessive weight for this height. The value was reached about age of 30 !

BMI - body mass index (graph no. 2) is calculated value. This parameter demonstrates a proportion between body height and weight. In other words, how much the body weight is accordant with the body height. The values above 25 are considered as an excess weight. This value was reached at the age of 35. BMI shows significant break at the process about age of 33.

Percentage of body fat (graph no. 3) and **skin folds** (graph no. 4) are the next parameters concerning body composition. Value above 15 % of body fat is considered to be level of a higher health risk. This figure is reached at the same age, e.g. at 35 years. Percentage of body fat is raising constantly without any significant break. On the other hand some skin folds (e.g. abdominal skin fold and subscapular skin fold) begin to raise more rapidly about the age of 33.

The same situation may be seen at the evolution of some **segment perimeters** (graph no. 5). Perimeter of hips seems to be almost unchanged during ageing. On the contrary, perimeter of waist has similar process as the skin folds. That means the break at curve evolution can be find at the age of 33 as well.

Blood pressure (graph no. 6) is parameter which use to increase steadily at the ageing process. However we discovered slight deterioration at a systolic blood pressure about the age of 37. Warning circumstance is that average blood pressure of officers at the age of 50 is approaching value of 150/95. The risk of cardiovascular diseases is really high. The diastolic blood pressure tends increase steadily throughout the whole process of ageing.

Two biochemical parameters were chosen. **Triacylglycerol** (graph no. 7) shows sharp break at the age of 33. The level of high health risk (2.2 mmol/l) is reached at the age of 46. **Cholesterol** (graph no. 8) is raising steadily during all observed range. Opposed to triacylglycerol level of high risk was not reached and no break at the progress was found.

The last parameter we focused on is **W170/kg** (graph no. 9). W170 is measured by exercise bike and presents working capacity (output power) upon heart rate of 170 bpm. Measurement units are watts. W170/kg is parameter for determination of efficiency and capacity of organism. This parameter decrease slowly and steadily during ageing. Values are slightly above average in comparison to Czech population.

3. Conclusions

The results show some significant trends at the evolution of basic biochemical and anthropometrical parameters during lifetime. In other words, we discovered the most critical age when Czech population's health tends to get worse rapidly. The main interest of physicians and physical trainers should be aimed to the group of this age or rather slightly before this age is achieved.
It's obvious a few parameters that were presented can't exactly demonstrate trends at evolution of parameters describing real health state. The problem is much more complicated and many other examinations have to be carried out in order to obtain more exact information.
The whole system of examinations contents of about 60 parameters. After first year of operation we know this system works. It may be effectively use for control of the most risky parameters. And when some abnormalities occur physicians together with physical trainers are able to cure them. Since this system is applied regularly (minimum twice a year), every increasing health risk is monitored in time. Anyway, recent results shows that health state of selected group of Czech soldiers is - to the certain extend - really alarming. It seems that physical condition and health in general deteriorates steeply after approximately 35 years of age. The worse is that officers after 50 years of age are in permanent danger of health problems. We suggest to aim main interest to group bellow age of 35. These people should be educated in order to get maximum information about methods of the health problems prevention.

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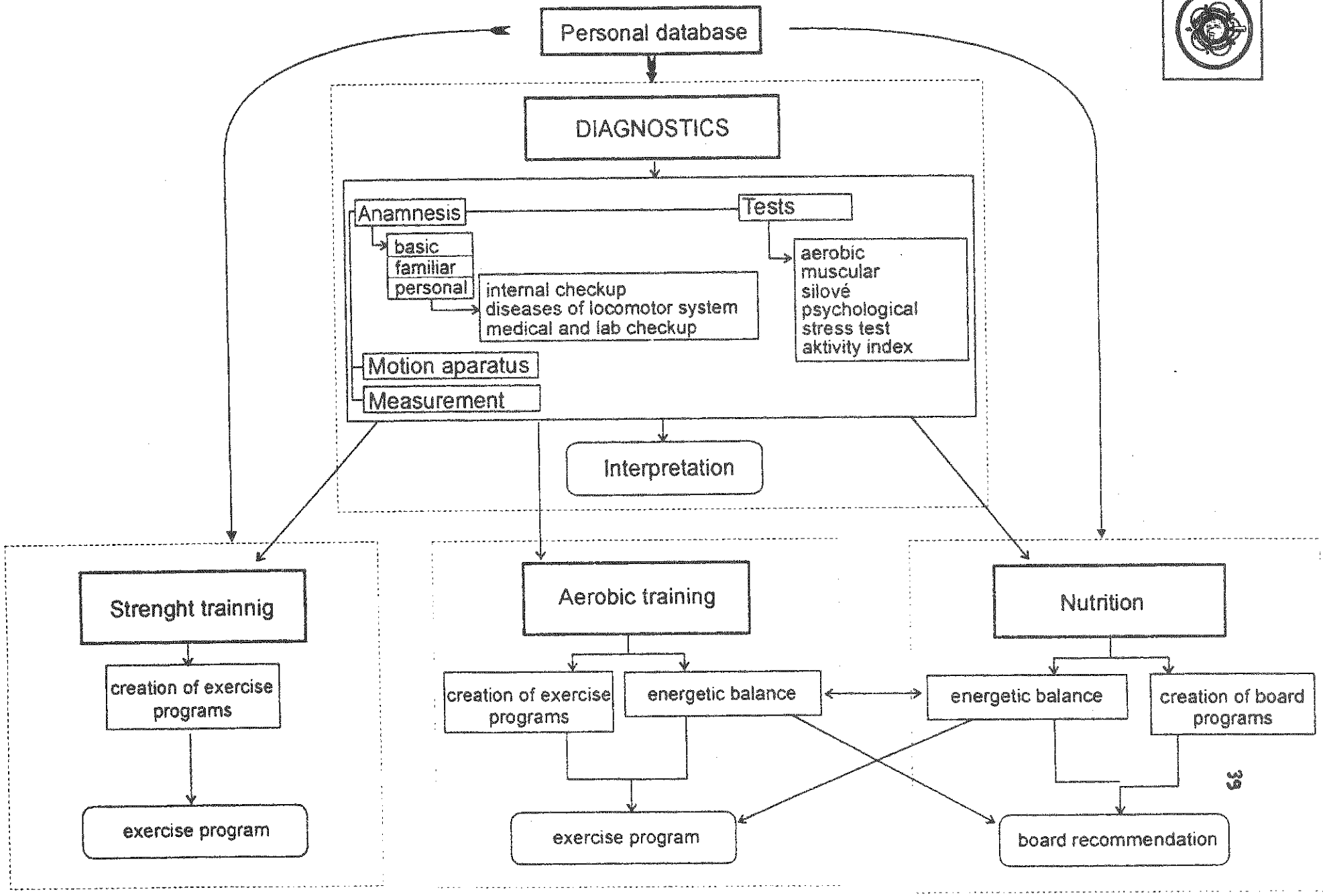

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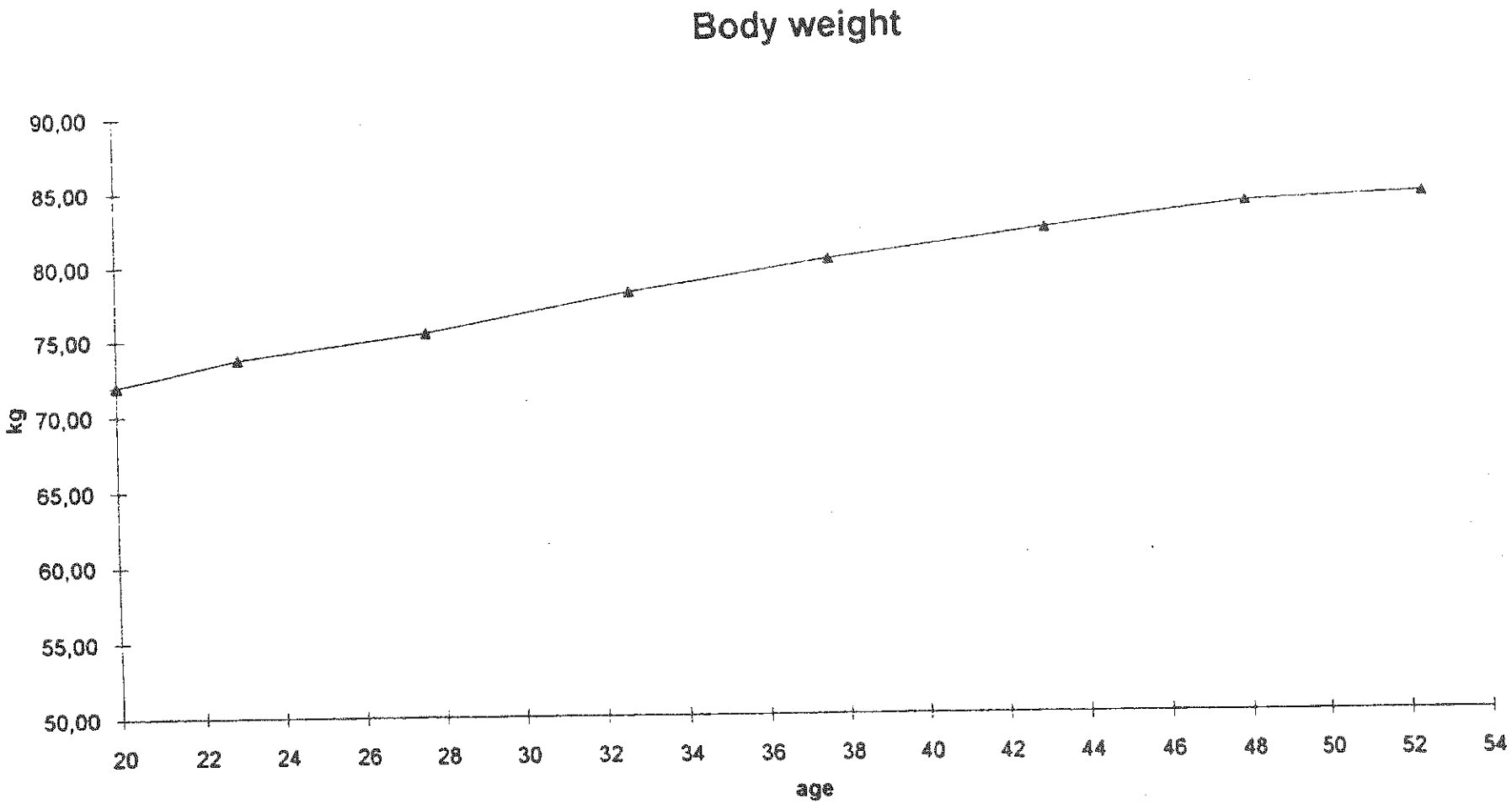

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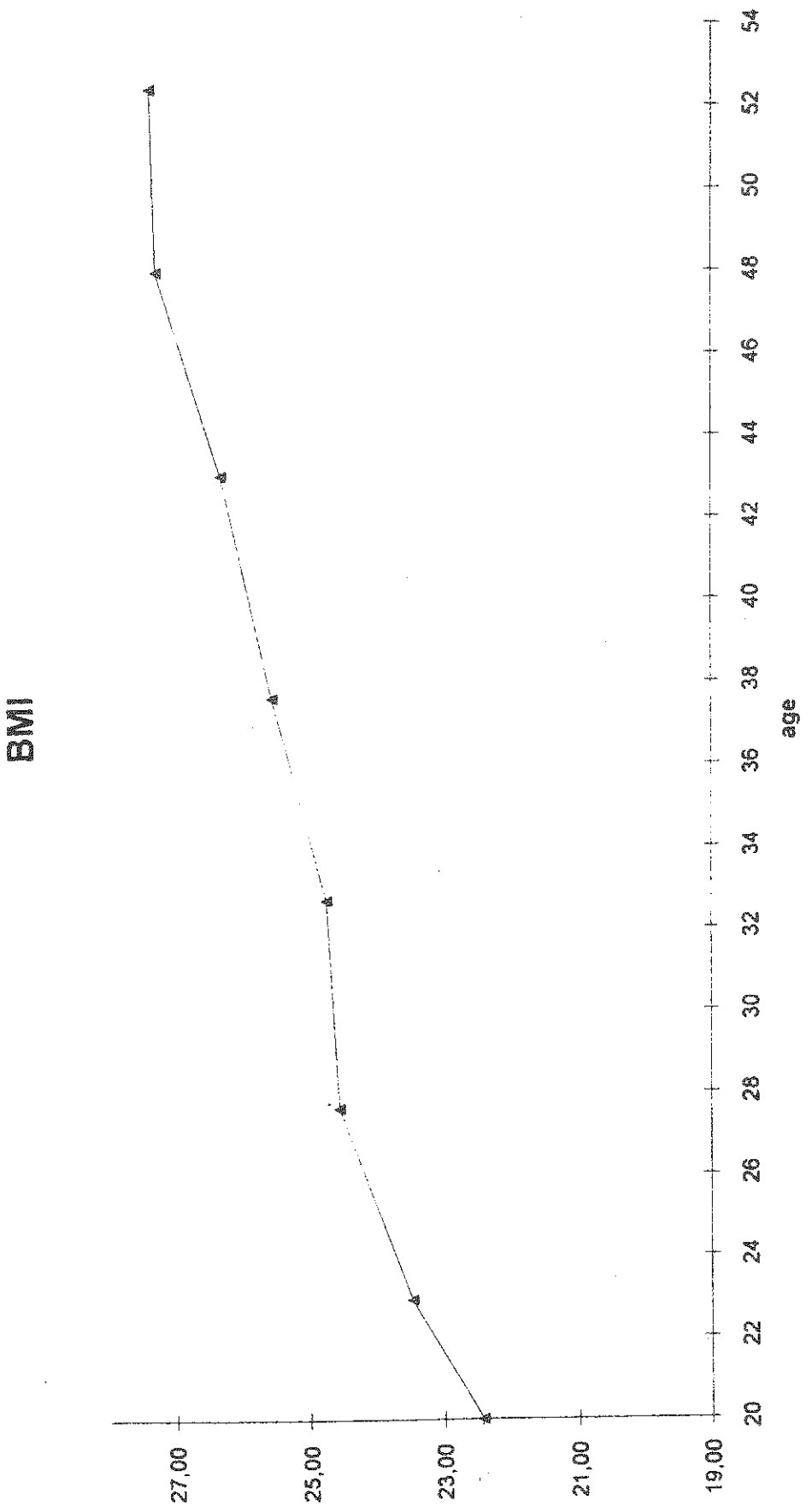
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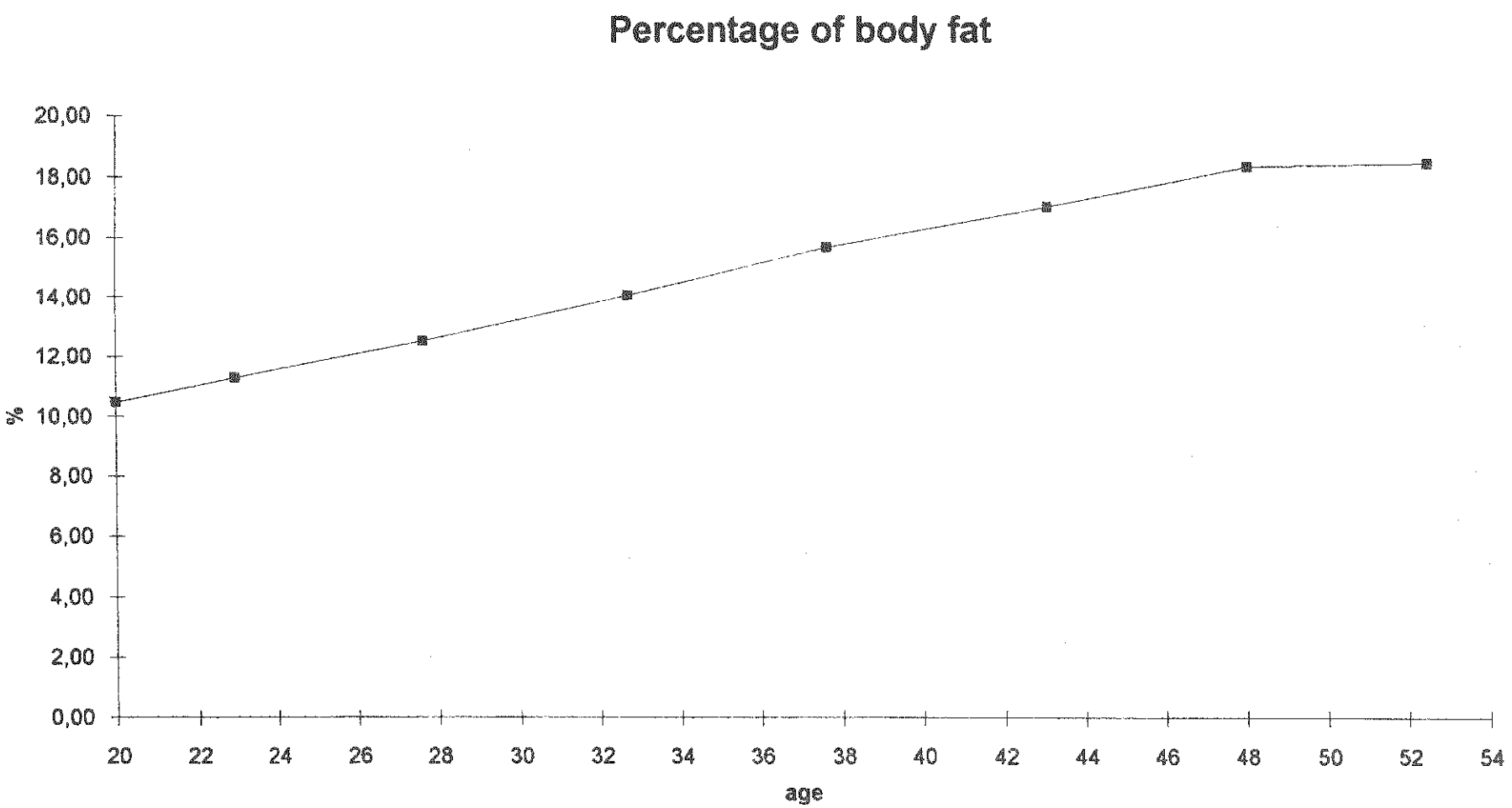
graph no. 3



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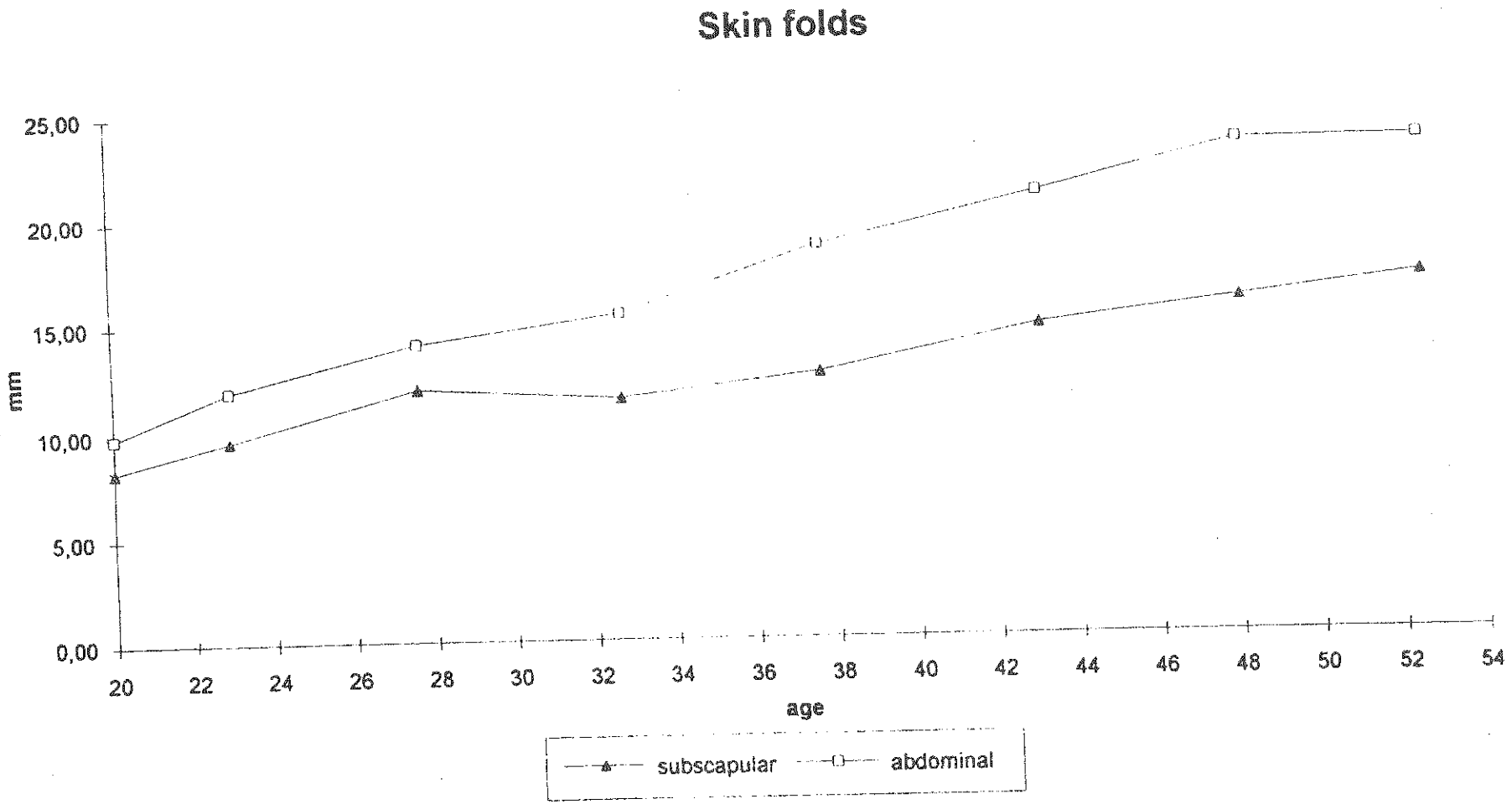

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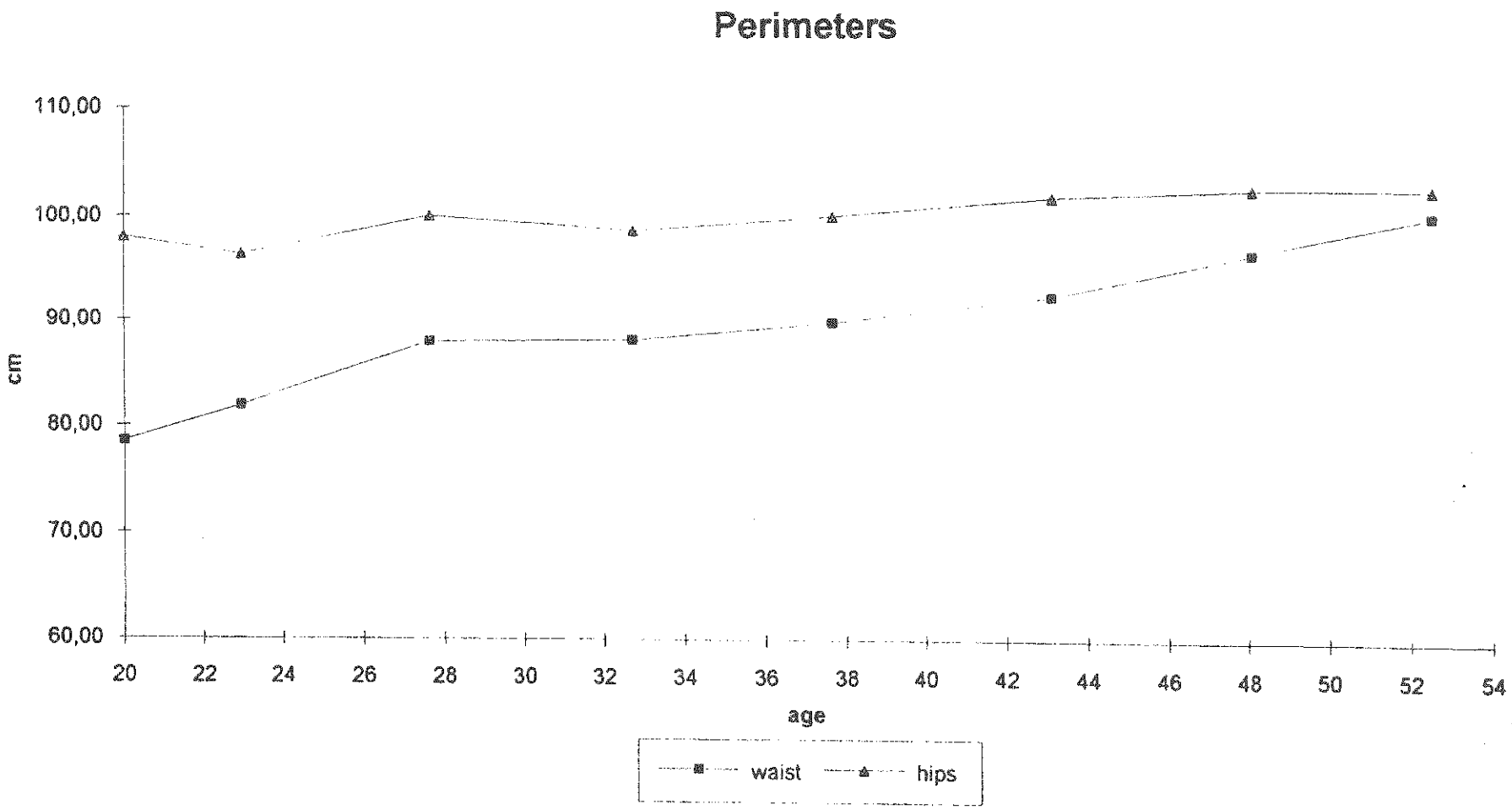

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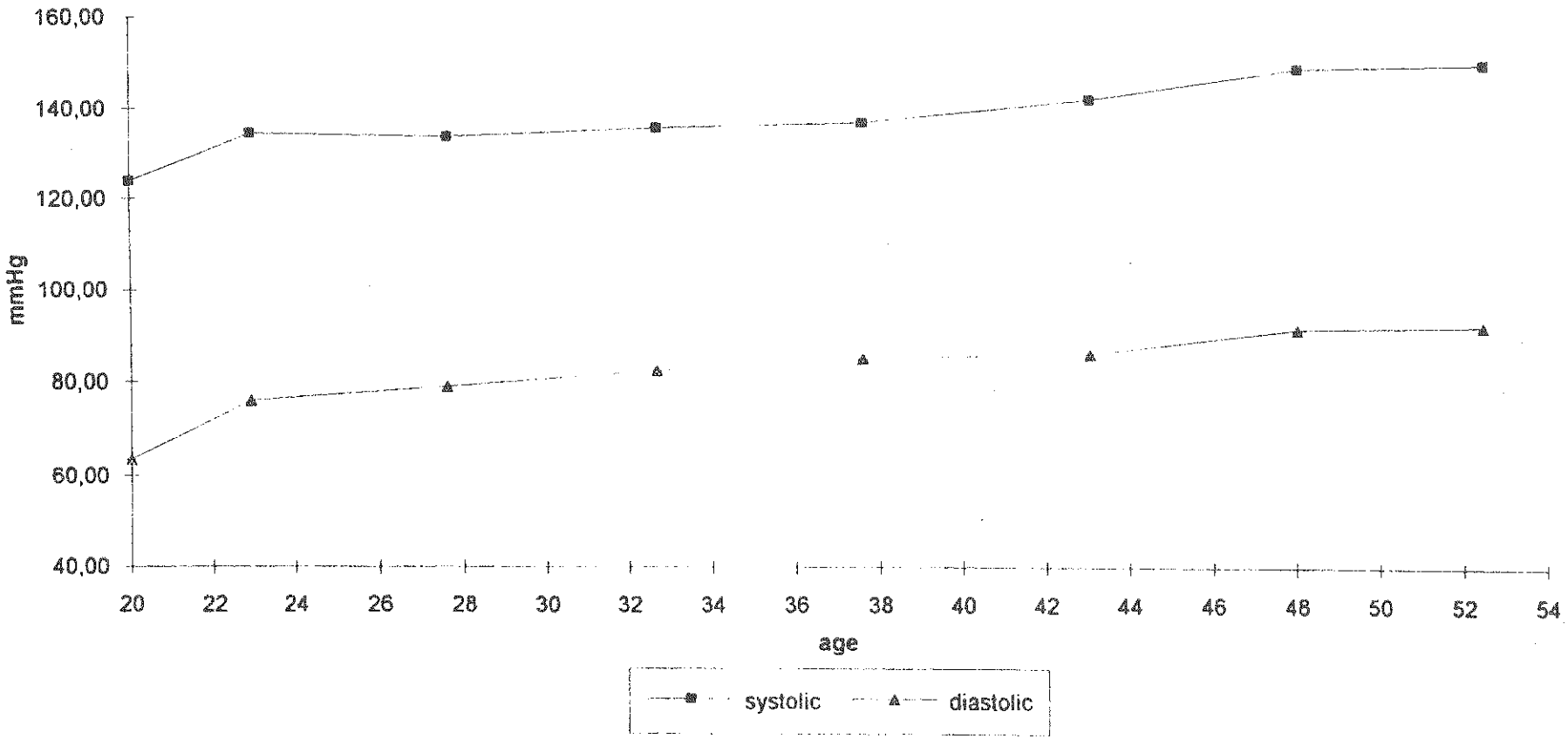

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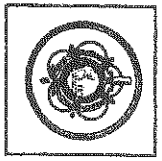
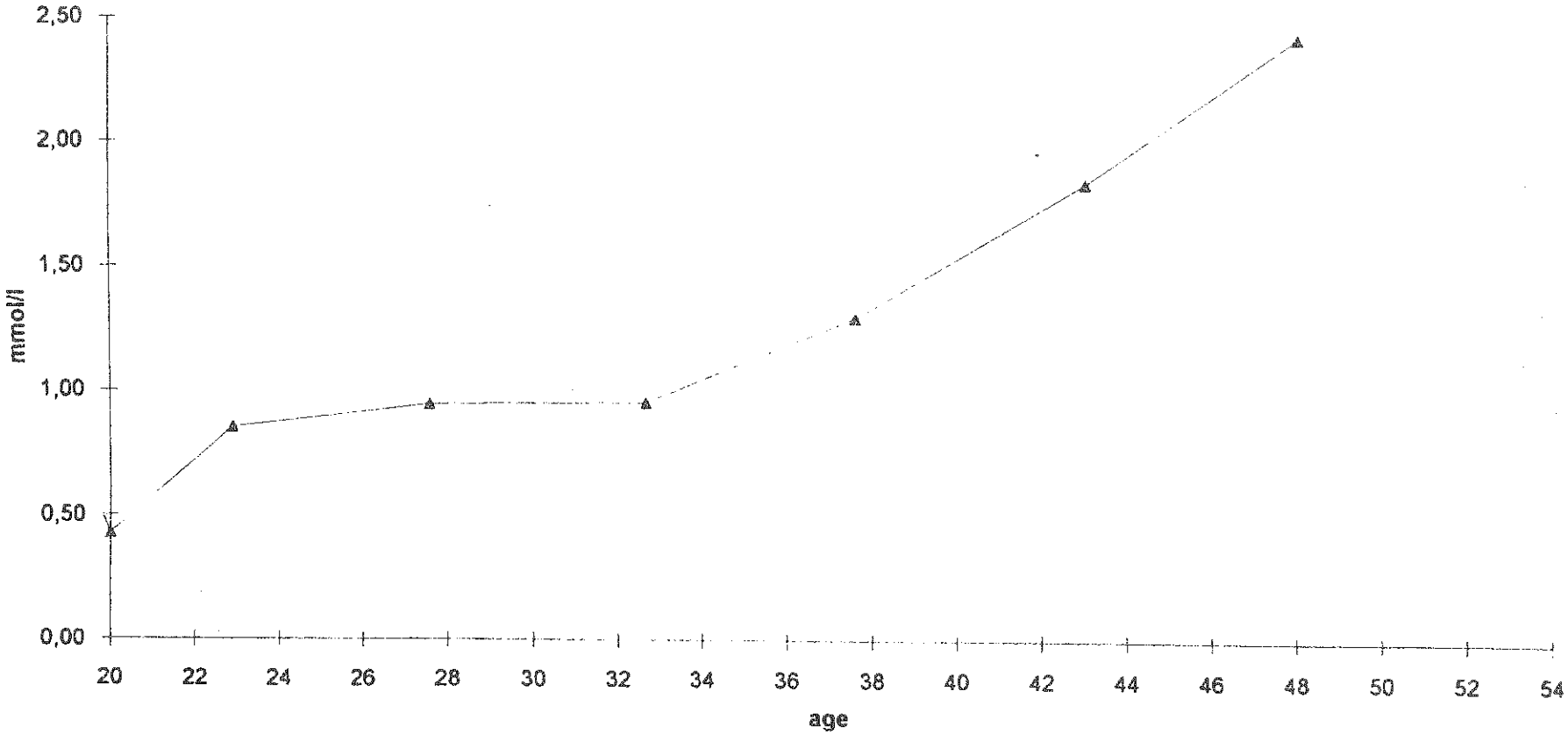


Triacylglycerol



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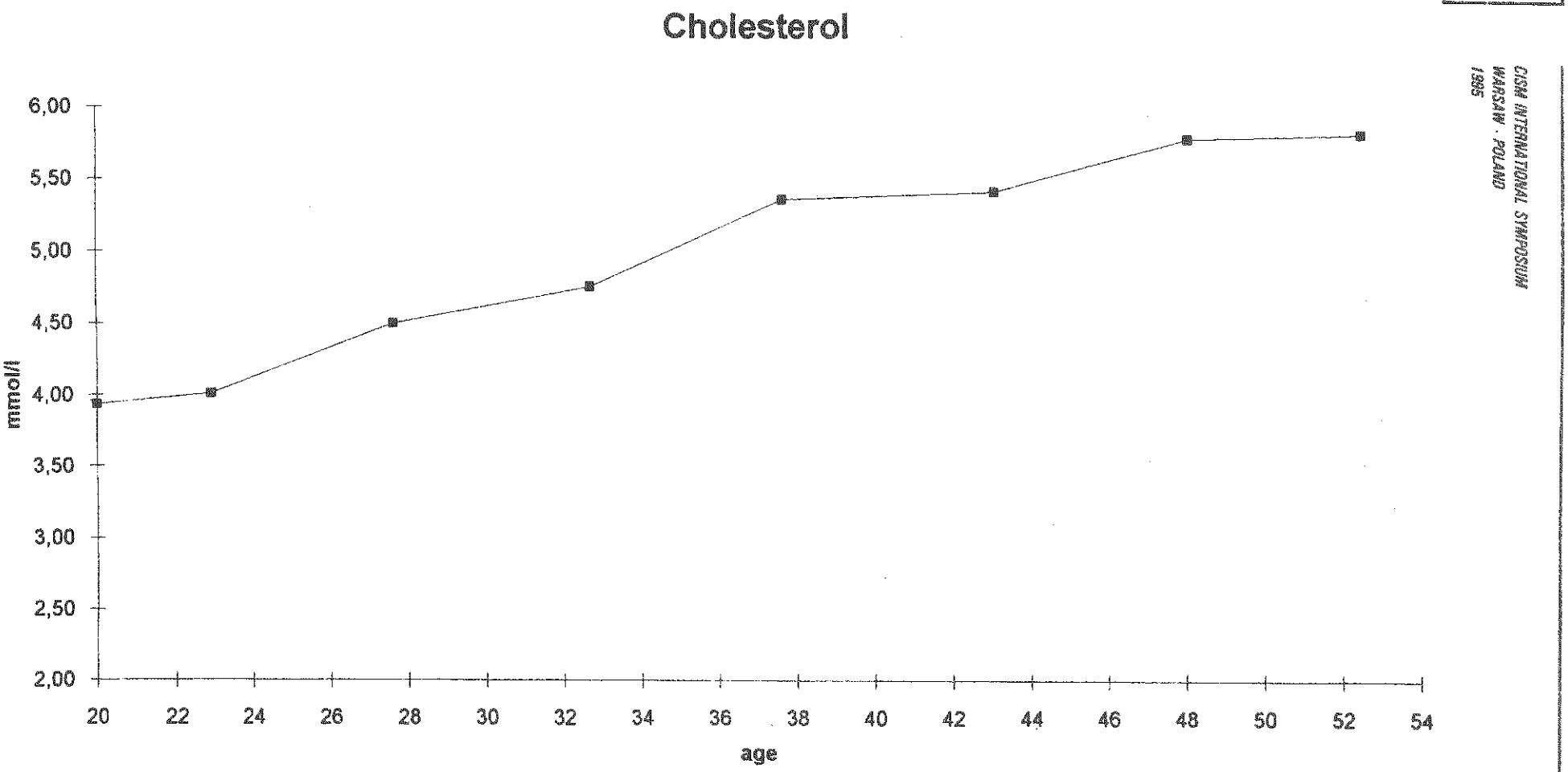

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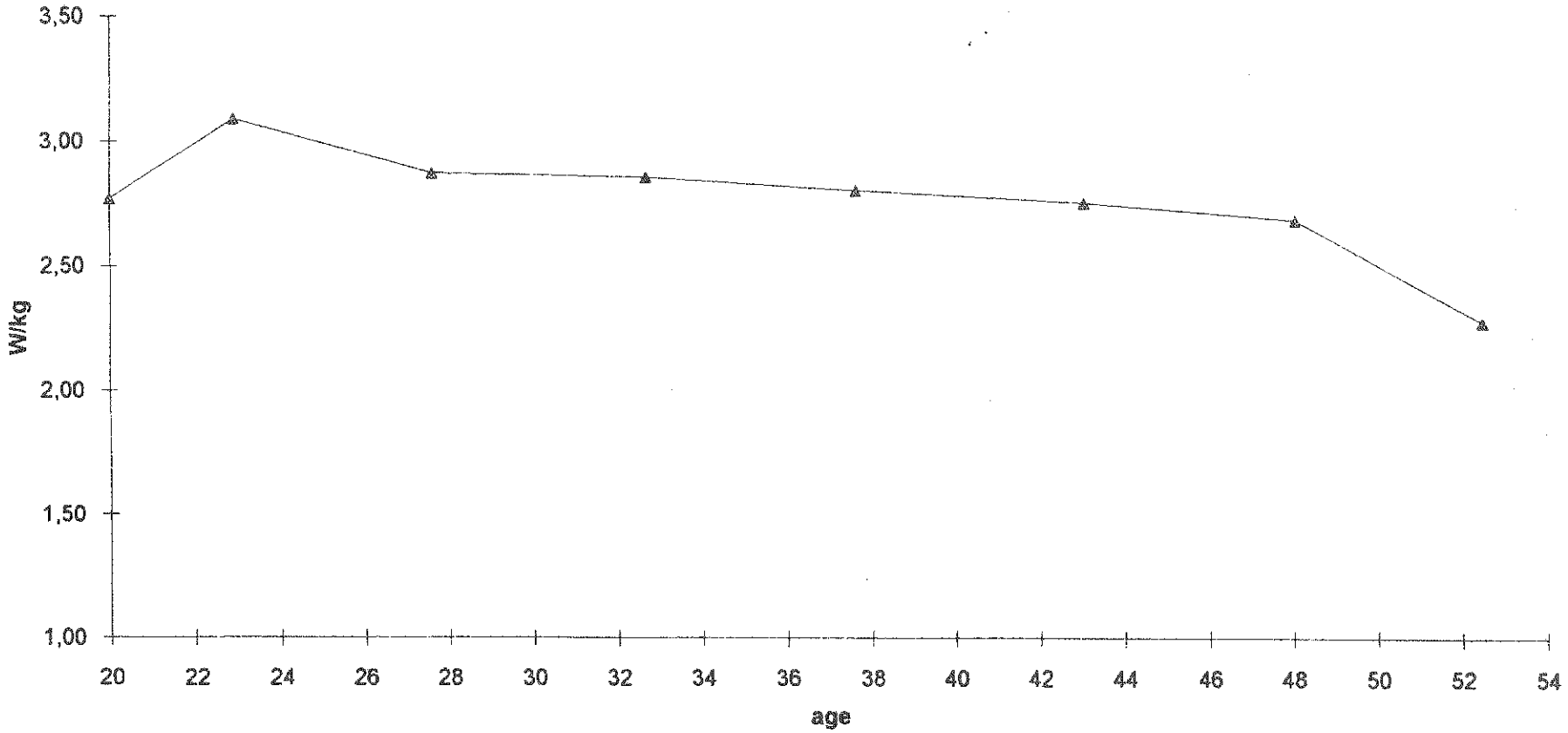

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