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MEASUREMENT OF BODY COMPOSITION BY DEXA NUTRITION CENTRES

Measurement of body composition by DEXA NUTRITION CENTRES



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1. Scope

This procedure is to be followed by the ECRIN Nutrition Centres when performing Measurement of body composition by DEXA.

This procedure describes the steps necessary to achieve the measurement of body composition using DEXA densitometer in order to calculate the total body fat of a subject.

2. Responsibilities

It is the responsibility of the Management team in the Nutrition Centres to ensure that this procedure is adapted and followed.

3. References

- Mesure de la masse adipeuse totale Ostéodensitomètre Lunar iDXA - ICAN- investigation.
- Mode Procedure for Dual Energy X-Ray Absorptiometry (DEXA) Scans - Physiology Laboratories - University of Nottingham Medical School
- SOP Measurement of body composition by DEXA - Diogenes
- Council Directive 97/43/Euratom of 30 June 1997 on health protection of individuals against the dangers of ionizing radiation in relation to medical exposure, and repealing Directive 84/466/Euratom
- Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation
- JORF French Official Journal Decision of 20 April 2005 laying down the procedures for quality control of densitometer devices using ionizing radiation

4. Terms, definitions, abbreviations

DEXA: Dual-Energy X-ray Absorption

ECRIN: European Clinical Research Infrastructures Network

Sv: Sievert: unit used to give an assessment of the impact of radiation on humans

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SOP: Standard Operation Procedure

5. Documentation

6. General

Dual-Energy X-ray absorption (DEXA) is used to measure body fat, lean tissue and bone mineral content. The measurement of these components using DEXA is based upon the principle of differential absorption by the components of body fat and lean tissue assuming that no bone is present in the region being measured.

The purpose of this Standard Operation Procedure is to ensure that the process of measuring the total body composition by DEXA for Nutrition Centres is performed under standardised conditions.

7. Safety Considerations

Operator radiation

The DEXA scan emits X-rays. The densitometer is installed in a monitored area. All staff who have to work when the densitometer emits X-rays (ie Quality Control and Examination) is subject to an active dosimetric control. All staff who has to work in the densitometer room must have a dosimeter. Operators working in the room must limit their presence in the monitored area and systematically check that the doors remain closed throughout the duration of the scan.

In case of problems, the densitometer has an emergency stop system. Any incident must be reported to the Quality Manager who will contact the Radiation Protection Service of the hospital

Patient radiation and Previous x-ray procedures

The radiation dose for a total body composition scan (duration 6-11min) is around 3 μ Sv and is approximately 100X less than the radiation dose of a chest x-ray.

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The volunteer's total yearly x-ray dose should not exceed 1mSv as recommended by legislation. Therefore subjects who have had a CT scan, angiography or a diagnostic x-rays in the previous year may not be suitable to scan.

DEXA should not be carried out on volunteers who have had either of the following procedures within the previous week; radiopaque agents or radionuclides

Barium meal/enema investigations

Nuclear medicine investigations involving isotopes

Pregnancy testing

Female volunteers of child-bearing age should not be scanned if there is a chance that they may be pregnant.

8. Materials

- Weight Scale
- DEXA software
- DEXA Densitometer



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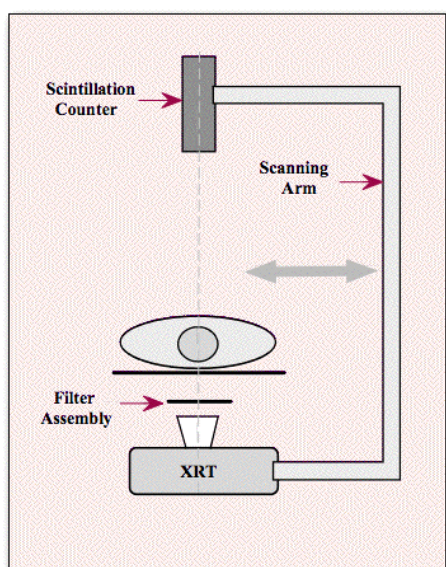


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Série Lunar iDXA



1-Roll of paper 2-Cale for the table 3-Arm Scanner 4-Control Panel 5-Switch on/off



9. Calibration of DEXA-scanner

For quality control and equilibration, a calibration block of tissue-equivalent material with three bone-simulating chambers of known bone mineral content should be scanned each morning prior to scanning and a spine phantom with a known mineral content should be scanned once a week.

These checkpoints help ensure that subjects will not be subjected to unnecessary X-rays.

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Accuracy of the DEXA is monitored by executing a daily Quality Assurance scan using a phantom block of known attenuation coefficient value

10. Patient preparation

To standardize the scan, the measurement of body composition must be carried out in similar conditions throughout a study or a specific clinical protocol. Therefore, it is desirable that the subject is scanned at the same time of day during the whole study with the same fasting condition.

Metallic objects

During the scan all kinds of metal should be avoided because they can affect the result of the DEXA Scan. Therefore Volunteers will be asked to change into surgical scrubs or light clothing if their clothing contains metal or zips. All jewellery and piercings should be removed. When these items cannot be removed, subjects will be asked to wear them during subsequent scans, for consistency.

Previous surgery, prosthetic devices and foreign bodies

If the volunteer has had surgery performed in the area of examination, the results may not be valid, particularly if there is a prosthetic device, metal implants or foreign bodies., pacemaker leads, radioactive seeds, metal implants or surgical staples present. The same caution applies to the presence of foreign bodies such as shrapnel or radio-opaque catheters/tubes.

In addition If the subject has undergone tests involving radiopaque agents or radionuclides on the week before analysis, the can should be postponed until the traces of these agents are cleared from the body of the subject.

Fasting condition

When Scanning in fasting condition, the subjects should be fasting from 8.00 PM the night before the scan. No food should be allowed after 8.00 PM, but they may drink until

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24.00 PM. Alcohol is not allowed the day before. On the day of the scan subjects should stay fasted in the morning.

Hydration status is a constant assigned and used in the DEXA software algorithms.

Therefore volunteers should refrain from heavy exercise for at least 12hrs prior to the scan.

If Scanning in fed condition to standardize the scan, the subjects should be fed a standardized amount of lunch + beverages.

11. Advice to patients

Advise patient that this is a simple and painless procedure, and requires very little preparation.

The volunteer should be given adequate explanation of the experimental protocol to ensure that an 'informed' consent to participate is given.

Ask the patient to wear light clothing and to remove all metal objects including jewelry because they can affect the result of the DEXA Scan.

Inform the patient that the actual scanning time is about 10 minutes but you should allow 30 minutes for the entire procedure and that the radiation dose for a total body composition scan (duration 6-11min) is approximately 100X less than the radiation dose of a chest x-ray.

Advise female volunteers of child-bearing age that they should not be scanned if there is a chance that they may be pregnant.

Ask volunteers to void their bladder before the scan is carried out.

Inform the volunteer that during the scan he will need to lie still on a padded table and to breathe normally. A detector located in an 'arm', positioned above the bed, will sweep over him from head to feet.

12. Placement of the subject

In order to achieve the best results it is important to place the subject as correct as possible. Please follow the specific instructions from your DEXA-manual.

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Center the subject within the scanning frame positioning the top of the head at 3 cm from the upper line.



If the subject is too tall for the scanning area, we emphasize to exclude a part of their feet from the scan.

If the subject is too broad to fit within the scanning area, a hemi-scan will be performed, such that the whole of the right side of the body, and where possible the whole of the trunk lies within the scanning area.

The function of MirrorImage™ enCORE software enables automatic evaluation of body composition of the body part that is outside the frame duplicating the scanned part.

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The arms are placed close to the body with the palms placed against the thighs. The hands should not touch the legs, and little space (approx. 1cm) should be left between the arms and torso if possible.

The legs should be strapped firmly together using one or two Velcro straps on the thighs and calves.

Use a 200 cm x 40-50 cm sheet to wrap the arms as close to the body as possible. The sheet has a double function in supporting the subjects in lying still during the scan and strapping them together in order to achieve the best possible fit.



9. Scan mode

Height, weight and date of birth of the volunteer will be required to set up the DEXA machine.

Ask the subject to keep calm, not to move and to breathe normally for the duration of the scan.

Once the subject is positioned correctly, start the acquisition;

The acquisition takes about 6-9 minutes depending on the subject's weight.

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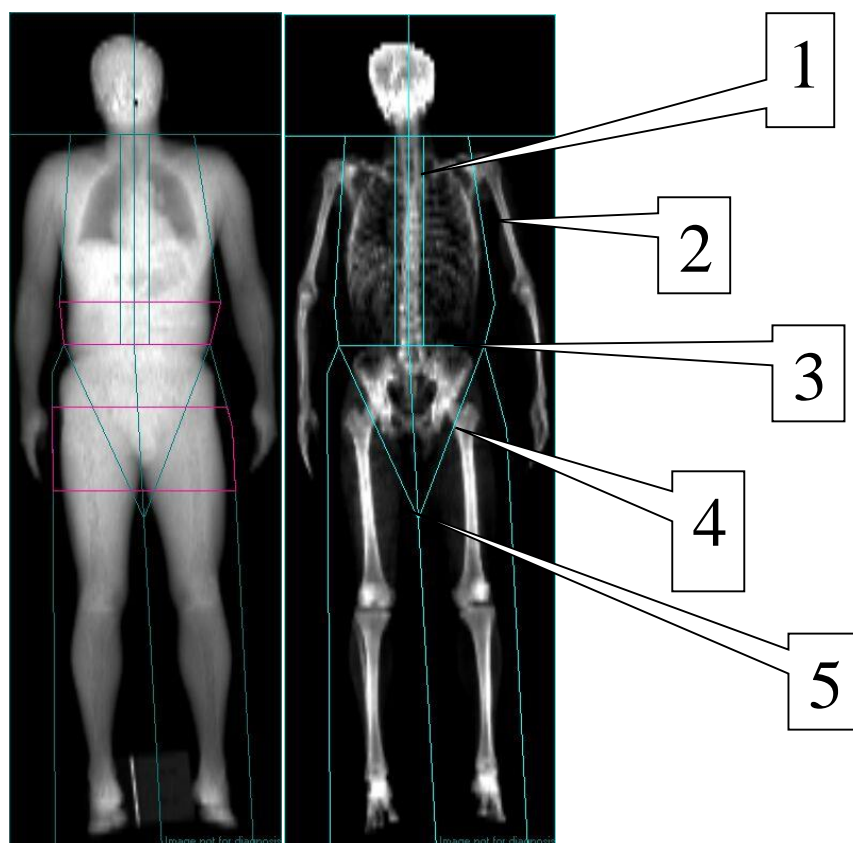
Use the scan mode emphasized by the manufacturer. In most cases this will be the slowest possible scan mode. For each subject it is recommended to use the same scan mode during the whole study.

10. Analysis and calculation of total body fat

Please refer to the instructions manual with regard to how to perform a manual analysis.

To optimize the analysis it is important that all centres use the same cut off points.

Therefore the operator has to manually adjust the lines separating different body parts as follows:



Vertical lines:

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Along both sides of column without touching it.

For lateral separation of the upper body adjust the vertical lines going through the spine (arrow 1).

Use both skeleton and soft tissue as guidelines and try to separate the arms from the trunk (arrow 2).

Horizontal lines:

An upper line approx. 1 line underneath the chin.

A horizontal line placed just above criste iliaca/pelvis (arrow 3).

Diagonal lines:

Diagonal lines through collum femoris (arrow 4) following the pelvis down to the pelvis tip (arrow 5).

Results of the DEXA scan

The DEXA Software can calculate total body and Regional assessment of:

Percentage of Fat

Fat mass

Percentage of Lean tissue

Lean mass

Bone Mineral Content (BMC)

Bone Mineral Density (BMD)

The software can also calculate the body mass index (BMI), the resting energy expenditure (REE), and the skeletal muscle index (IMS).

Exclusion of poor quality scannings

To be accepted as perfectly completed we require that the difference between the scanned total weight and scale weight should not exceed 5% **2%??** of the scale weight. No participants are normally excluded on this basis except subjects who are too huge/voluminous to be scanned (weight typically above 130 kg or height far above 200 cm).

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11. Limitations & Pitfalls of the Examination

Do not exceed the weight limit of the DEXA table.

In cases where participants are very tall this would mean, that we constantly miss parts of the feet, which is considered to be the best compromise.

Sources of potential variables are obese women due to a high bias between the weight measured by the scale weight and the weight estimated from the whole body scan as well as the top athletes because of the thigh muscles compared to the segmentation of the legs and trunk in enCORE software.

18. Method Validation

Local methods

19. Procedure Notes & Other Pertinent Information

N/A

20. Appendices

N/A