

Anthropometric measurements of workers inside the fougura, a field investigation in select fugaras in Adrar city (Algeria)

Chermak Abdelmalik ¹, Ben Khaled Abdelkarim ^{* 2}

Education and Development Laboratory, Adrar University (Algeria),
chermakmalik@univ-adrar.edu.dz

Education and Development Laboratory Adrar University (Algeria),
benkhaled@univ-adrar.edu.dz

Received: 20/03/2025, **Accepted:** 24/09/2025, **Publication:** 30/09/2025

Abstract:

This study aims to investigate the anthropometric body dimensions of workers engaged in Al-Fougara, the traditional channels used for water transportation in certain desert regions. The study adopted a descriptive approach suited to the subject's nature by examining physical attributes. A questionnaire was utilized as the primary data collection tool, specifically designed to encompass various bodily parameters that may influence worker performance within Al-Fougara. The study identified key anthropometric measurements relevant to the nature of work in Al-Fougara, revealing that height, arm length, and lower limb length are fundamental factors that significantly enhance work efficiency. Given the physically demanding nature of labor in a confined and low setting, these body dimensions play a crucial role. Furthermore, the findings emphasized that workers possessing these suitable measurements can navigate and perform more efficiently, thereby improving both productivity and comfort during their tasks. Based on these results, the study recommends incorporating these body measurements into the recruitment process for this sector, along with the development of specialized training programs to enhance workers' adaptability to the challenging conditions of Al-Fougara.

Keywords: Body dimensions; Anthropometric analysis; Al-Fougara laborers.

** Corresponding author*

INTRODUCTION

Morphological measurements are "a branch of anthropometry that studies the measurement of the human body from the external structural aspect only, i.e. it is the science of measuring structure" (Hassanin, 1981, p. 43), and this includes measurements of height, weight, volume and circumferences of the body as a whole, and different body parts, and here it becomes clear that morphological measurements are a special science concerned with external measurements of the human body.

Body measurements play an important and complementary role to the rest of the specifications that the worker must have, such as physical specifications, in different types of activities. Each type of activity requires specific physical specifications that the worker must have to be suitable for the requirements of the work and achieve high levels of activity performance. Body measurements play a major role in the success of motor performance, as excellence in operations such as drilling depends on the suitability of the worker's body composition to perform the required work.

In addition, body measurements play an important role in choosing the type of work that is appropriate for the individual. Cureton also proved that workers in some jobs are distinguished from their normal peers in many body measurements, which reflects the impact of these measurements on the individual's ability to perform certain types of work effectively.

Body measurements are a basic rule for workers as they facilitate the digging process and also facilitate sand extraction with appropriate and balanced steps. It is known that body measurements also affect the worker's performance. Through what we have discussed, the following question can be raised: What are the body anthropometric measurements for workers inside the vertebra, a field study in some Al-Fougara of Adrar?

- Are measurements (height and length of the arms, length of the lower limb) important for Al-Fougara workers?

1-1-Hypotheses:

- There are body anthropometric measurements for workers suitable for inside the Al-Fougara.

- Measurements (height and length of the arms, length of the lower limb) are important for Al-Fougara workers.

1-2- Study objectives: Our study aimed to:

- Body anthropometric measurements for Al-Fougara workers.

- Knowing the individual differences in body measurements between individuals

- Knowing the body characteristics of the Al-Fougara workers.

- Identifying the nature of the relationship between the most important body measurements and some kinematic variables in the Al-Fougara workers.

1-3-The importance of the study:

Our study represents an important step towards acquiring knowledge and information about anthropometric body measurements in the field of sociology. This field encourages researchers and students to explore new dimensions related to body structure and its impact on performance and social interaction, instead of being limited to psychological and social aspects only. Understanding body measurements can open new horizons for understanding social and cultural interactions, and contribute to enhancing research in various fields such as sociology, anthropology, physical education and sports, in addition to medical and health sciences.

The importance of body measurements in particular in the field of Al-Fougara drilling workers lies in that they contribute to

Anthropometric measurements of workers inside the fougura, a field investigation in select fougars in Adrar city (Algeria)

understanding the physical requirements of the job and determining the extent to which their body structures are suitable for effective performance in this type of work. Applying this knowledge can lead to improving working conditions and worker safety, in addition to achieving better and more efficient performance in work environments that require intense physical effort.

1-4- Study Concepts:

1-4-1 anthropometry:

The science of measuring the human body and its various parts, where this science is used in studying human development to identify the changes that occur to it in form. (MATHEWS, 1987, p. 87)

It is a branch of anthropometry that seeks to measure the human body from a structural perspective only, i.e. the science of measuring the structure. (Hassanin, 1979, p. 43)

1-4-2 The Al-Fougara: are waterways that start from the well, passing through the orchard channels, and their length is about 100-150 meters, their height is about 80 cm, and their width is about 60 cm. These channels are mostly found in desert orchards that help them in irrigation

1-4-3 Operational definition:

It is a scientific method used to describe the morphological body shape (length, arm length and lower limb length) in a quantitative way where it can be statistically analyzed and the results can be drawn from it by the workers of the Faqara in Adrar.

2- Method of constructing the Al-Fougara and its most important components:

The process of constructing the Al-Fougara is considered a complex process that requires precise planning and ancient technical knowledge. This process begins after choosing the appropriate location for the starting point, which is the point where the mother well is dug, where this matter is entrusted to men with experience and skill in this matter, and they are the ones who have experience in determining the location of groundwater (Saqni, 2017, pages 179-180). They are specialized men called teachers or palace teachers. This technician specializes in knowing the methods of discovering the appropriate moisture ascent points and detecting water using a nail and a metal wire that indicates the location of the water, which is in the expert's hand. (Laraj, 2007, page 236)

After determining the starting point, the workers who will carry out this process must be identified, as they are specialized in this field and supported by the residents of the area to begin the process of drilling the first well, the mother well, which may be the main source of Al-Fougara water source. It should be taken into account that it is at the highest point of the slope. After that, the second, third and fourth wells are drilled, and so on. The process of drilling wells and digging the ground channel linking the wells continues. The latter allows for the connection between one well and another and allows water to flow from the first well to the next well. Here, the slope ratio is taken into account to facilitate the flow of water to reach the palace or oasis directly on the ground to the channel, which is a main canal. (Saqni, 2017, pp. 179-180)

Al-Fougara consists of several procedures so that each one does not play its role in the absence of the other. Among these components, we find:

2-1 The main well, the source: It is the first well in Ras Al-Fougara and is deeper than the other wells, so it has a great driving force and is clean and not neglected because it is newly formed. (Taheri, 2023, p. 156)

Anthropometric measurements of workers inside the fougura, a field investigation in select fougara in Adrar city (Algeria)



Picture No. (01) shows the main well of the Al-Fougara system.

2-2 Working wells: These are wells to complete service and maintenance work carried out by workers specialized in this field, thus increasing the water yield of Al-Fougara and are often exposed to sand accumulation, which works on the cave and reduces the flow of water in the tunnels. (Marouf, 2011, page 268)

2-3 Access: It is a groove or tunnel that connects Al-Fougara wells to transfer water through these wells to the end of Aghisro El-Saqia. This type of Al-Fougara differs from one Al-Fougara to another in terms of size depending on the force of the Al-Fougara pushing the water. (Marouf, 2011, page 268)



Picture No. (02) shows the exhaust of the Al-Fougara.

2-3 Aghosrou (the primary canal): It is a place to receive water from the loyal tunnels to be directed to the Qaysariya and then it is distributed at the entrance to the orchards to distribute them to them.



Picture No. (03) shows the outlet of Aghousrou.

2-4 Al-Qasriya:

It is a basin for collecting water that ends with a stone comb through which water flows towards the irrigation channels. It is a fragile stone in which many small holes are made to drain the water.

The condition for the al-Qasriya is that the surface from which the water jumps is equal between all the holes so that there is no imbalance in the distribution of water. The increase and decrease are only on the sides of the holes. This al-Qasriya grows and shrinks according to the size and smallness of the Al-Fougara. In the Al-Fougara are classified according to the speed of water flow, it is required to place a scale before the al-Qasriya to limit the rush of water and make the distribution more just. It is done according to a precise mathematical economic method so that each partner takes his share of the water. We distinguish two types of al-Qasriya. (Marouf, 2011, p. 268)

Anthropometric measurements of workers inside the fougura, a field investigation in select fougara in Adrar city (Algeria)



Picture No. (04) shows the main Caesarea

2-5 The main Caesarea: It is the first Caesarea of the vertebra. Its location comes directly after the Hisar. The first division of water is usually according to the sides, meaning that each side takes its share of the vertebra.



Picture No. (05) shows the Secondary Caesarea.

2-6 the Secondary Caesarea: It is multiple because it comes after the first division, and this coercion may contain two or more partners similar to the primary coercion that includes all partners

2-7 Al-Majan: It is a basin located at the beginning of the orchards in which the water of the share of the participant or owner of the water is collected, and it is the last basin in which the water is collected for irrigating the farmers



Picture No. (06) shows a picture of the Majan.

3- Research methodology and field procedures

3-1- Research methodology

The researcher used the descriptive method to suit the nature of the problem to be studied, (Deo Boldb, 1985, page 348)

3-2- Data collection tool:

3-3-1 Questionnaire

The researcher used the questionnaire form for surveying the opinions of experts and specialists* to determine the most important physical characteristics and body measurements affecting the process of drilling the Al-Fougara.

Anthropometric measurements of workers inside the fougura, a field investigation in select fougars in Adrar city (Algeria)

3-3-1 Body measurements

After collecting the survey forms for physical characteristics, the researcher used the percentage law to choose the nominated body measurements and the researcher relied on a percentage of 50% and above, and the table below shows that:

Table No. (1) shows the body measurements and their percentages

Body Measurements	Percentages
Body Height	%100
Body Weight	%84
Arm Length	%67
Torso Length	%84
Legs Length	%100

First: Body length (Mohamed Ali, 1994, page 70)

The body length is measured by a graduated wooden board (200 cm) fixed to a wall and a metal indicator slides on it. The worker stands barefoot on the ground with his back resting on the wooden board vertically on the ground and the worker's gaze is forward and his head is straight. The researcher lowers the indicator onto the worker's head and reads the length measurement at the metal indicator's pointer.

3-3-1: Body weight

It is measured by an electronic medical scale and the reading is rounded to the nearest (500 g).

3-3-2: Arm length (Radwan, 1997, page 85)

It is measured by a tissue measuring tape from the lateral crest of the acromion process of the plate bone to the tip of the lowest point in the lower phalanx of the middle finger.

3-3-3: Trunk length (Radwan, 1997, page 86)

It is measured by sitting on the seat, and it is the distance from the surface of the seat on which the worker is sitting to the first point of the neck.

3-3-4: Leg length (Ibrahim, 2001, page 278)

It is measured from the greater trochanter of the upper head of the hip joint to the ground ((the worker should be barefoot))

3-3-5: Chest circumference Inhale

It is measured using a textile measuring tape by placing the measuring tape horizontally around the chest, taking care to wrap it from behind around the bottom corner of the two plates and from the front it wraps over the nipple of the chest, noting that the worker's arms are down when reading while taking the largest possible breath.

3-3-6: Chest circumference Exhale

It is measured in the same way as chest circumference Inhale while emptying the lungs of air as much as possible.

3-3-7: Hip circumference

It is measured by wrapping the measuring tape around the buttocks at the level of the horizontal surface of the body.

3-3-8: Abdominal circumference

It is measured by wrapping the measuring tape horizontally around the smallest circumference of the middle area in the area above the two iliac bones.

3-3-9: Thigh circumference

It is measured by placing the measuring tape horizontally around the thigh and in the area from behind directly below the fold of the mechanism.

3-3-10: Leg circumference

Measured by wrapping the measuring tape horizontally around the maximum circumference of the leg.

3-3-11: Chest width

The legs of the pulvometer are placed on the horizontal extension of the middle thoracic region* (on both sides of the rib cage) with the legs moving in all directions until the largest chest width is obtained.

3-3-12: Shoulder width

The ends of the pulvometer are placed on the highest point of the other two protrusions on the lateral side.

3-3-13: Pelvic width

The ends of the legs of the pulvometer are placed on the two most forward points on the side.

3-2-Statistical methods:

The researcher used (SPSS) as well as the manual method and the arithmetic mean and standard deviation were found.

4- Presentation and analysis of the results:

4-1 The first hypothesis: The height level of the the fougura workers.

Table No. 02: Shows the Student's T-test for one sample

	mean	Standard deviation	T-test	Sig	Statistical decision
Length (cm)	179	6.42	3.41	0.00	+

From the table, we note that the arithmetic mean of height was 179 with a standard deviation of 6.42, while the value of T was 3.41 at a significance level of 0.05. Since the significance value is less than the significance level of 0.05, this means that the height level of the vertebral workers is important.

The result can be interpreted as individuals with different heights may face difficulties in adapting to inappropriate furniture, which can lead to injuries or pain due to uncomfortable sitting or standing positions. Therefore, it is encouraged to design workstations and choose furniture taking into account these individual differences to ensure the comfort and health of workers and increase productivity in the work environment.

The importance of allocating the necessary furniture and equipment in the workplace based on the characteristics of workers, including height, is highlighted.

Some studies indicate that allocating the height of furniture and working tools in the workplace based on the individual's height contributes to reducing physical stress and fatigue, which leads to increased comfort and productivity. For example, adjusting the height of tables and chairs to suit the individual height of workers may be useful in avoiding back and neck injuries.

Anthropometric measurements of workers inside the fougura, a field investigation in select fougars in Adrar city (Algeria)

4-2 The second hypothesis: The level of arm's length among the al-fourara workers. Table No. 03: Shows the Student's t-test for one sample

	mean	Standard deviation	T-test	Sig	Statistical decision
Arms length(cm)	77.03	4.88	4.25	0.00	دال

From the table, we note that the arithmetic mean of arms length was 77.03 with a standard deviation of 4.88, while the value of t was 4.25 at a significance level of 0.05. Since the significance value is less than the significance level of 0.05, this means that the level of arm's length among the workers of the vertebrae is important in the drilling process. The result can be interpreted as the length of the arms being a very important element in the drilling process for several important reasons. First, the length of the arms directly affects the worker's ability to reach work points effectively and safely, as it can contribute to improving access to tools and equipment without the need for unnatural bends or frequent extensions of the arms. Second, the compatibility of drilling tools with the dimensions of the body can reduce the risk of injuries resulting from physical tension and excessive fatigue, which improves the comfort of workers and increases their efficiency during long working periods. Finally, paying attention to the compatibility of work tools with the dimensions of the body enhances general safety at the work site, which contributes to reducing work accidents and improving the work environment in general. These points highlight the importance of the level of arm length as a vital factor in the drilling process, which highlights the importance of designing tools and equipment in a way that suits the body details to enhance safety and efficiency in industrial work environments.

4-3 Hypothesis 3: The level of lower limb length among the al-fourara workers.

Table 04: Student's t-test for one sample

	mean	Standard deviation	T-test	Sig	Statistical decision
Bottom limb length (cm)	107.8	7.11	3.89	0.00	دال

From the table, we note that the arithmetic mean of the lower limb length was 107.8 with a standard deviation of 7.11, while the value of T was 3.89 at a significance level of 0.05. Since the significance value is less than the significance level of 0.05, this means that the level of lower limb length among the vertebral workers is important. The result of the hypothesis can be interpreted as reflecting the importance of understanding this factor in the context of drilling operations. Based on the statistical analysis, understanding this factor can lead to the development of more integrated and effective work techniques and tools that contribute to improving the overall performance of vertebral workers and reducing the risk of injuries associated with inappropriate lower limb length. Therefore, this result is an important step towards a better understanding of performance and safety factors in work environments, which contributes to improving the quality of professional life of vertebral workers. Conclusion: The study clearly shows that the level of height, including arm length and lower limb length, is a critical factor in the performance of vertebral workers during drilling operations. These findings provide valuable insights into how to design work environments and plan tasks to ensure comfort and safety for workers, which leads to improved overall efficiency and reduced risk of injury.

Anthropometric measurements of workers inside the fougura, a field investigation in select fougars in Adrar city (Algeria)

Recommendations:

- **Design work environments:** It is recommended that work site designs be adapted to provide conditions that suit the natural height of workers, which helps reduce body strain during long and intensive work.
- **Improve work tools:** It is recommended to develop and use work tools that allow adjustments to suit different body heights, such as drilling tools and heavy equipment.
- **Training and awareness programs:** Provide regular training programs for workers and supervisors on the importance of physical health and adapting to changing work environments.

Suggestions:

- **Future studies:** Further studies should be conducted to better understand the effects of height on work performance in other sectors with similar physical activity characteristics.
- **Continuous improvement:** Research and innovation in work designs and techniques should continue to enhance the safety and comfort of workers in various work conditions.

References

1. Abdel Aziz Laraj. (2007). Al- fougars in the Touat region and its impact on community life, a historical and archaeological study. Thesis for a PhD in Islamic Archaeology, Institute of Archaeology, University of Algiers.
2. Abdel Salam Hussein. (2012). Contribution ratios of some anthropometric measurements to skill performance after modifying the dimensions of the court and its equipment using human engineering (ergonomics) for junior volleyball players. Palestine: An-Najah University Journal for Research: Humanities. Vol. 26, No. 2.

3. Abdelmalek Taheri. (2023). The Touat region in the 19th century AD through the writings of travellers and explorers. A thesis submitted to fulfil the requirements for a PhD in History, Specialization: Contemporary Algerian History, Faculty of Humanities, Social Sciences and Islamic Sciences, Ahmed Daria University, Algeria,
4. Amara Al-Jilani. (2017). The extent of compatibility of anthropometric measurements of university furniture with the physical dimensions of students, a field study at the Faculty of Humanities and Social Sciences, Ain Khaldoun University, Tiaret. Algeria: Journal of the Researcher in Humanities and Social Sciences.
5. Khawla Hafsa. (2021). Comfort while sitting among university students and its relationship to chair design - An anthropometric study. Algeria: University of Oum El Bouaghi.
6. Marwan Abdel Majeed Ibrahim. (2001). Scientific Encyclopedia of Volleyball, 1st ed. Amman: Al Warraq Foundation.
7. MATHEWS, D. (1987). Measurement in Physical Education, 5th. W.Bsunder Co Philadelphia.
8. Mohamed Nasr El Din Radwan. (1997). Reference in Body Measurements, 1st ed. Cairo: Dar Al Fikr Al Arabi.
9. Mohamed Sobhi Hassanein. (1979). Evaluation and Measurement in Physical Education. Cairo: Dar Al Fikr Al Arabi.
10. Mohamed Sobhi Hassanein. (1981). Evaluation and Measurement in Physical Education, 1st ed., Vol. 2. Cairo: Dar Al Fikr Al Arabi.
11. Muhammad Saqni. (2017). fougargas, an extinct archaeological heritage in the palaces of Ain Salah in Tidikelt. Scientific Horizons Journal, Volume 09 (Issue 02).
12. Nazir Marouf. (19/20 January, 2011). Water Resources in the Desert: Evaluation, Economy and Protection. International Seminar on the Ressource of Water in the Sahara: Evaluation, Economy and Protection.
13. Van Dalen Dew Boldb. (1985). Research Methods in Education and Psychology (Translation) Muhammad Muhammad Nabil Noufal and others. Cairo: Anglo-Egyptian Library.

Anthropometric measurements of workers inside the fougura, a field investigation in select fougareas in Adrar city (Algeria)

14. Yaqubi, A. (2020). Relationship between anthropometric characteristics and spatio-temporal parameters in freestyle swimming. Algeria: Elibdaa el-Riadhi.
15. Yassin Taha Mohamed Ali. (1994). Functional Responses after Long-Distance Running in Hot and Moderate Weather, PhD Thesis. University of Mosul, College of Physical Education.