v. 4, n. 21, 2024

Journal of
Engineering
Research

ANTHROPOMETRIC DATA OF PEOPLE WORKING IN THE PACKAGING OF SPARAGUS (sparagus) IN COSTA DE CABORCA, SONORA MEXICO

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Abstract: The research developed here is the first part of a series of investigations to be carried out in the agricultural coast of H. Caborca, Sonora, Mexico. In the first stage of this work, some anthropometric dimensions of the agricultural workers who work as asparagus packers were recorded, in order to generate an anthropometric database for the realization of a second stage where the design of workstations and tools that can be adjusted to the needs and capabilities of the workers will be carried out. It is important to have a database of the anthropometric measurements of the asparagus packing workers of the coast of H. Caborca, Sonora, Mexico. The relevance of having this anthropometric database of asparagus packing workers becomes important at the time of designing workstations or tools, so that the worker does not have to adapt to his work environment and that, based on the results of this research, at a later stage an optimal workstation can be made for the performance of his activities as an asparagus packer, that is, that the work area adapts to the worker and not vice versa.
Keywords: anthropometry, ergonomics, workers, asparagus packing, agriculture.

INTRODUCTION

In the region of Caborca, Sonora, Mexico, one of the main crops is asparagus, generating at least 20 thousand jobs and having a demand that revolutionizes the local and regional economy (Nicols, 2024). According to data from the Office of Agricultural Information and Fisheries (Oiapes) and the Ministry of Agriculture, Livestock, Water Resources, Fisheries and Aquaculture (Sagarhpa) in 2023, 8,835 hectares were planted in the municipality of Caborca to obtain a production of 90,650 tons, which places it as the main regional, state and national producer.

The first part of the asparagus process is the harvesting or cutting that is done in the field, after this first stage comes the process that is the focus of this research, which is the packaging of the asparagus. The packaging of the asparagus is the presentation in which it will be marketed, in this second stage it is important to take into consideration the requirements established by the client or buyer, since this product is sent to different countries with special requirements for each one of them to which it is exported, They ask for different sizes of the vegetable and packaging presentations, either by their cultures or preferences, but that is where the human talent or labor comes in, where each packer is responsible for classifying the asparagus by its thickness and then cut them depending on the size required and then pack them.

A decent job is one in which the worker is fully respected, where there is no discrimination, where he/she has the right to social security, obtains a remunerative salary, and is also in optimal safety and hygiene conditions to prevent any occupational hazards (Ley Federal Del Trabajo, 2022).

Asparagus packing is manual; therefore, failure to carry out these ergonomic practices can lead to muscle, tendon, joint and nerve injuries, as well as conditions such as carpal tunnel syndrome, tendinitis, bursitis and back pain, among others.

In both men and women, neck and shoulder disorders are very frequent and work-related factors, such as physical and psychosocial origin, as well as the person's lifestyle have been found to be associated with the prevalence and incidence of neck and shoulder disorders. Repetitive hand and finger movements, monotonous work tasks and awkward postures are examples of such factors (Fredriksson et al. 2002).

The main function of anthropometry is to determine the measurements of the human body, such is the case of the study developed in the city of Guayaquil, Colombia, where the measurements of the workers of a beverage

industry were recorded with the objective of knowing the data of the workers in order to design the workstations and thus increase productivity and reduce ergonomic risks and avoid musculoskeletal injuries or diseases (Freire Freire, J. 2024). The work developed by (Arrocha, M. F., Fernandez, G. D. P., Diaz-Perera, C. A., Perez, E. A., & Aseff, H. P. 2024) shows the anthropometric indicators related to blood pressure alterations in apparently healthy adolescents which aims to determine the relationship that some anthropometric indicators may have with blood pressure alterations in adolescents, this shows that anthropometry is a tool that can be used for various activities in terms of improving actions where the human is present, the same happened with the work of (Borda Yusty, A. M.., García Castillo, A. M., & Lombana Espinosa, T. J. 2024), which focused on investigating informal workers who develop in the coffee sector of Viotá Cundinamarca in Colombia, where the problems of musculoskeletal disorders were sought with the aim of trying to reduce them.

Ergonomics is a very broad science that is developed in several areas as evidenced by the study of (V. Ramirez, A., 2006) where the Andean population working in mines in the central highlands of Peru was measured with the participation of three thousand mine workers or the other research developed by (Bahr-Ulloa, S., Agüero-Gómez, F., & Carvajal-Veitía, W. 2023) where they used anthropometry in which they sought to systematize the studies of body composition through subcutaneous adipose tissue by ultrasound to measure subcutaneous fat and identify the health status of people. On the other hand (Donates González, N., Betancourt Morffis, U., & León Reyes, Y. 2022) looking for the ideal safety and health at work to improve the productivity of the Administrative Processing Center in Matanza Cuba, they elaborated an anthropometric study for the redesign of the work centers.

The priority in this first stage of the research is to obtain a record of anthropometric measurements so that in a second or third stage we can avoid, reduce or eradicate any type of injury or musculoskeletal disorders due to poor posture when packing asparagus.

With the data obtained from the measurements we can be certain of the capabilities and physical scope of the people who perform the asparagus packing work, so as not to leave anyone out, so that they can fulfill their task without having to make an extra effort than they are capable of.

The work tools used in their daily work as workers can be adjustable to their needs and physical reach, to avoid any risk and have a good harmony; thus promoting postures that are natural with smooth movements, to reduce the likelihood of injury.

These and many more reasons are the ones that we seek to address in this research with asparagus packing workers in the region of Caborca, Sonora, Mexico in the registration of anthropometric data and contribute to improve the quality of life of workers, providing them with optimal workstations and tools, which are of utmost importance for the good performance of our agricultural plant on the coast of Caborca, Sonora, Mexico.

OBJECTIVE

Through research and the necessary anthropometric equipment, in this first stage we want to obtain a database of agricultural workers who work in asparagus packing on the coast of Caborca, Sonora, Mexico. Giving the possibility of a second or third stage, where the realization of work spaces and / or tools that facilitate and significantly reduce any risk of injury and / or musculoskeletal disorders possible in their work environment is carried out.

DELIMITATION

The study has certain limitations due to the production dates of the asparagus crop, which is a short period; in the case of Caborca, depending on the climate, it has a duration of 4 months regularly from December to March, which makes data collection difficult and the cost required for transportation to the place of harvest.

METHODOLOGY

INTRODUCTION

For the recording of anthropometric data of asparagus packing workers in the coastal region of Caborca, Sonora, Mexico, the procedures defined and classified in the book published by NASA (National Aeronautics and Space Administration), 1978, will be considered. Anthropology Research Project 1978 Anthropometric Source Book, Vol. I: Anthropometry for Designers.

DESCRIPTION OF THE METHOD

The data recorded were made in a cross-sectional observational manner from a convenience sample of 100 asparagus packing workers on the coast of Caborca, Sonora, Mexico.

MATERIALS

The following equipment was used for the development of the research:

- Two anthropometers model 01140, 01290 and 01291 Lafayette brand.
- Two Clarita model anthropometric kits.
- One Seca stadiometer.
- One Seca analog scale.
- Two Stanley Powerlock flexometers.
- Two flexible tape measures.
- A computer for recording information.

The methodology for taking the measurements was as follows:

Data collection was performed by two teams of two people, while one took measurements the other wrote down the data, workers were taken at random, who were performing their work on a daily basis as asparagus packers, these were called in pairs by the process supervisor to perform the measurements, which were taken in a space in the nursing area.

The 24 measurements shown in Table 1 are those that were recorded for the case study of this work, where the worker was standing, the procedure followed for each of the measurements is the one shown in the book published by NASA (National Aeronautics and Space Administration), 1978. Anthropology Research Project 1978 Anthropometric Source Book, Vol. I: Anthropometry for Designers.

Code	Size name
N920	Weight
N805	Height
N328	Height at standing eye
N23	Height at shoulder standing
N309	Height at elbow standing
N949	Height at waist standing
N398	Height at buttock standing
N973	Height at wrist stationary
N265	Height at middle finger standing
N797	Width of outstretched arms
N798	Width of elbows to center of chest
N80	Arm length to wall
N122	Width of shoulders standing
N223	Standing chest width
N457	Standing hip width
N144	Distance from ear to ear above the head
N427	Head width
N441	Length of head
N420	Length of hand
N656	Length of palm of hand
N411	Width of palm of hand
N402	Grip diameter(inside)
N529	Height from ground to knee
N381	Length elbow to middle finger

Table 1. Measurements recorded in the study.

ANALYSIS OF RESULTS

The results obtained from the investigation of the anthropometric measurements of the agricultural population of asparagus packing in the region of Caborca, Sonora, Mexico, showed that of the 100 workers who participated in the anthropometric data analysis sample, 64% were men and 36% women. The average age of the men was 25 years, with the lowest age being 18 years and the highest being 40 years. In the case of women, the average age was 26 years, where the youngest recorded was 20 years and the oldest 40 years. Table 2 shows the anthropometric dimensions recorded for men and Table 3 shows the results for women. Tables 2 and 3 show the calculations of the 5th, 50th and 95% percentiles, as well as the maximum and minimum of the measurements. The recorded data were analyzed with the Excel spreadsheet. The calculation of weight is given in kilograms, the rest of the measurements are in centimeters.

CONCLUSIONS AND RECOMMENDATIONS

Anthropometry is a tool that we should take advantage of and use in the work environment. This anthropometric database of asparagus packing workers on the coast of Caborca, Sonora, Mexico, should be useful for agricultural and non-agricultural companies, given that it can be considered so that the people who work in this type of work are in accordance with their dimensions due to the differences that exist in the measurements of the human body, and knowing these measurements can favor their activity.

Of the 100 people involved in the anthropometric study in the asparagus packing plant on the Caborca coast, 64% were men and 36% were women.

Of the 24 measurements considered in the study, the different percentiles show the significant differences between the extremes, i.e. the maximum and minimum of the measurements. With this database, it is possible to take advantage of the opportunity to improve the workstations by adjusting them according to the percentiles appropriate to the dimensions of the participants.

Undoubtedly the applications of these measurement results should bring an important contribution to ergonomics, since it should initiate a second study for the design of workspaces and work tools according to the dimensions of those involved, thus considering improving their lifestyle and contributing to a reduction of musculoskeletal disorders and a safe and healthy work environment.

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		Percentiles				
Código	**Nombre de la medida**	**5%**	**50%**	**95%**	**Mínimo**	**Máximo**
N920	Weight	53	65	87	50	98
N805	Height	156	163	173	155	177
N328	Height at standing eye	143	151	163	141	166
N23	Height at shoulder standing	129	135	144	129	149
N309	Height at elbow standing	98	102	111	97	118
N949	Height at waist standing	85	90	97	80	100
N398	Height at buttock standing	65	75	83	65	87
N973	Height at wrist stationary	74	79	85	73	93
N265	Height at middle finger standing	61	64	73	60	76
N797	Width of outstretched arms	154	163	179	87	182
N798	Width of elbows to center of chest	41	68	87	33	94
N80	Arm length to wall	71	80	85	70	88
N122	Width of shoulders standing	42	45	50	40	52
N223	Standing chest width	28	31	34	28	37

N457	Standing hip width	31	34	38	30	39
N144	Distance from ear to ear above the head	16	18	20	16	21
N427	Head width	10	15	17	10	47
N441	Length of head	23	24	30	22	56
N420	Length of hand	17	18	19	12	19
N656	Length of palm of hand	9	10	11	9	11
N411	Width of palm of hand	8	9	10	7	10
N402	Grip diameter(inside)	3	4	4	3	4
N529	Height from ground to knee	42	46	51	39	60
N381	Length elbow to middle finger	42	44	47	40	48

Table 2. Results obtained from the 64 men registered in the study of agricultural workers in asparagus packing on the coast of Caborca, Sonora, Mexico.

		Percentiles				
Código	**Nombre de la medida**	**5%**	**50%**	**95%**	**Mínimo**	**Máximo**
N920	Weight	45	57	84	42	85
N805	Height	139	155	167	138	172
N328	Height at standing eye	130	144	155	127	159
N23	Height at shoulder standing	111	128	139	102	143
N309	Height at elbow standing	88	99	107	85	109
N949	Height at waist standing	84	89	96	77	99
N398	Height at buttock standing	67	75	82	60	87
N973	Height at wrist stationary	71	77	84	70	84
N265	Height at middle finger standing	58	64	69	57	70
N797	Width of outstretched arms	120	154	168	88	170
N798	Width of elbows to center of chest	39	43	81	37	82
N80	Arm length to wall	69	73	84	64	88
N122	Width of shoulders standing	40	42	46	38	51
N223	Standing chest width	26	30	35	24	37
N457	Standing hip width	30	34	40	25	40
N144	Distance from ear to ear above the head	15	17	20	14	27
N427	Head width	10	12	17	9	17
N441	Length of head	21	23	25	21	25
N420	Length of hand	16	17	18	15	19
N656	Length of palm of hand	9	9	11	8	11
N411	Width of palm of hand	7	8	9	7	9
N402	Grip diameter(inside)	3	4	4	3	4
N529	Height from ground to knee	40	44	50	38	52
N381	Length elbow to middle finger	37	42	44	32	45

Table 3. Results obtained from the 36 women registered in the study of asparagus packing workers on the coast of Caborca, Sonora, Mexico.