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# Chest circumference and Health. A Study on Italian Military Call-Up Registers (19th-20th C.)

## *1. Introduction*

In this paper we propose to investigate some aspects of the nutritional and health status of the population of Friuli in the second half of the nineteenth century by resorting to the measurements of chest circumference detected during medical examination for the recruitment in the Italian Army. After the presentation of the theoretical framework, we describe the demographic and economic characteristics of the investigated territory. We propose a study on some of the main determinants of chest circumference. Finally, we focus on the consequences that a smaller or greater supply of cereals could have on chest circumference.

## *2. Nutrition level and anthropometric measurements*

Nutritional level can be assessed directly from the body shape of individuals. A measure often used to determine the well-being of a population is the average height. Height identifies characteristics related to the health status and the level of nutrition of a population. Height is determined by a very complex interaction between genetic and environmental factors, that act throughout the phase of growth of an individual. The information content of height refers to the structural characteristics of these elements. Nutritional level can also be obtained with other measures, some of which are more sensitive to the conjuncture, such as weight or chest circumference. In contrast to height, in fact, these, like other indicators, can fluctuate not only during growth, but also during the later stages of life. Also in this case the literature is very wide, but not in a historical perspective.

## *3. The area under investigation*

The area investigated in this work covers a vast portion of Friuli, a region situated in northeast Italy. The study comprises virtually all the municipalities within the present province of Udine, historically the only urban centre in the whole area. Friuli is characterized by a vast range of environments and encompasses the wet plains of the south, the dry plains of the central area, followed by the hills and finally mountains of the north. During the 19$^{th}$ century, agriculture was the principal economic activity in the plains, and diminished in importance as altitude increased. The

secondary sector of the economy, which was represented almost exclusively by handicraft production, was particularly strong in the main towns, most notably Udine.

*4. Sources*

The first source is the Italian army's call-up records. These data are collected in the database Friuli/*in prin* which includes more than 350,000 records concerning subjects born in Friuli between 1846 and 1900 (Marzona and Fornasin 2007). The source provides information about the final decision of the military medical examinations, biographic data, occupation, literacy and about some physical characteristics of conscripts, such as height and chest circumference (Lamioni 2002). Occupations have been classified according to HISCO guidelines. The division into different categories was made taking into account the prevalence of occupations, the intensity of the activity required to practice them and the social status. The second source is the corn price series of Udine, the most important urban centre of Friuli. These data are collected since the beginning of the 17th century. For the period we are interested in, the information is published on a fortnightly or monthly basis in the statistical bulletins of the municipality of Udine. The third source is the series of temperatures measured in Udine, still published in the bulletins of the municipality.

*5. The model*

We use a linear regression model with chest index like dependent variable and four groups of independent variables: demographic; socio-economic, economic and environmental. The first group includes age at medical examination (expressed in months) and birth cohort. The socio-economic variables are occupation and literacy status. As economic indicators we used the price of maize and the season of the medical examination, that is connected to the intensity of work. As environmental variables we have included the temperature and the territory of origin.

*6. Results and conclusions*

The determinants of chest index are summarized in table 1.

Table 1. *The determinants of chest index*

| | Coef. | P>t |
|---|---|---|
| Age (months) | 0.017 | 0.000 |
| Birth cohort | 0.005 | 0.012 |
| Occupation (ref. Peasants) | | |
| Woodcutters | 0.752 | 0.000 |
| Masons | 0.100 | 0.001 |
| Kilnsmen | 0.102 | 0.003 |
| Artisans and blue collar | -0.380 | 0.000 |
| Tradesmen | -0.324 | 0.000 |
| Non manual occupations | -1.555 | 0.000 |
| Other | -0.038 | 0.391 |
| Literacy ref. Literate | | |
| Illiterate | -0.125 | 0.000 |
| Unknow | -0.127 | 0.000 |
| Maize Price | -0.137 | 0.000 |
| Season of medical examination (ref. Autumn and Winter) | | |
| Spring | -0.494 | 0.000 |
| Summer | -0.195 | 0.000 |
| Temperature | -0.020 | 0.000 |
| Territory (ref. mountain) | | |
| Hill | -0.013 | 0.648 |
| Plain | 0.046 | 0.106 |
| Udine | -0.147 | 0.000 |
| Cons | 41.031 | 0.000 |
| Number of obs | 82,396 | |
| F(18, 82377) | 116.36 | |
| Prob > F | 0.000 | |
| R-squared | 0.025 | |
| Adj R-squared | 0.025 | |

As expected, both age and year of birth are significant and positive. Cohort effect is important because it permit to us to keeps the secular trend under control, but it could also be interpreted as a medium-long term tendency to improve the general food situation of the population. Always significant, but not very influential, is also the variable day of medical examination.

In regard to occupation, in line with other work, we have chosen as a benchmark the category of agricultural workers, which is the most widespread in the territory. The workers with the largest chest index are the woodcutters. The particular tasks to which these workers were subjected to a particular development of the chest muscles. Even the workers distributed in the two categories of the construction sector have a chest index greater than that of the reference category. Among the occupational categories that result to have significantly less developed chest there are artisans and traders. It is difficult to assign the right meaning to this result, partly also due to the internal

heterogeneity of these groups. Among traders, for example, it is not always possible to distinguish between peddlers, certainly numerous in Friuli, and who cannot be ascribed to the wealthy categories, with that of the great traders and shopkeepers who had higher standard of living. In the same way, it is difficult to establish whether the craftsman of a small village could enjoy a better standard of living than that of a peasant or that of emigrant mason. One thing is certain: the work of most traders and artisans was lighter and less tiring than that of the occupational categories mentioned earlier. This can lead, and that is what probably happened, to a different dimensioning of the body of these people and in particular of the chest, due to a different and more contained development of the muscular mass. In fact, as it has been written: «Characteristically, the chest circumference was larger in the active, and smaller in the relatively inactive men. The reverse was true of the abdominal circumference, which was smaller in active, and larger in the inactive men. Statistically, the difference between the two circumferences was highly significant» (Brožek 1963, 7). In fact, the narrowest chests are those of non-manual occupations: clerical workers, journalists, students etc. According to the model, the literacy status is also associated with the width of the chest. In this case, the results are more difficult to read, as almost all the information on the oldest birth cohorts, those with more illiterate and characterized by a smaller chest, are missing.

As prices rise, the chest index falls. This result seems to support the hypothesis that the price of maize, intended as an indicator of the availability of food, referred to a period of time sufficiently close to the visit, may have its influence in determining the chest circumference. The season of the medical examination influence too the chest size. Compared to the reference season (autumn and winter taken together), spring and summer, have a significantly lower thoracic index value. This can be due in part because the most common manual occupations reach the peak of intensity in spring and summer.

The results on temperature do not support the hypothesis that the chest is larger in the warmer months, but, on the contrary, it is larger in the colder. This may perhaps be related to the fact that in the winter months the accumulation of fat mass was generally favoured because less energy was consumed in physical work.

From the territorial point of view, the reference is mountain. According to the results we can observe, there are no significant differences with hills and plains, while in Udine the chest index is significantly lower.