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Sebaceous and sweat secretions and age person's age

Summary

The article presents results of the relationship between the quantity of sweat and sebaceous secretions and the age of a person. The study was carried out in a group of 70 persons of various ages and both sexes. Basing on the results it may be concluded that the age and sex have a significant influence on the quantity of sweat and sebaceous secretions. This can be used during preparation of various test samples, for example competence tests for fingerprint examiners.

Key words: sweat and sebaceous secretions, fingermarks, skin morphology

Introduction

A definition of „trace” or “mark” (Polish: “ślad”) in *The Dictionary of Polish Language (Słownik Języka Polskiego)* is, as follows:

- „1. Marks left on the ground after person or vehicle's movement.
2. Traces proving that something has existed or occurred.
3. Minute quantity of something.

Trace – follow – track, search someone basing on traces, observe closely”¹.

In forensic examination, the concept of a trace or mark, according to Hans Gross includes “all impressions and reflections in the pliable material”. According to the definition by Jan Sehn, forensic traces are: “changes in the objective reality, which, as perceptible signs after the events that are the subject of the proceedings, may constitute the basis for reconstructing and determining the course of these events in accordance with reality” (Kędzierska, Kędzierski, 2011, pp. 28, 29).

Traces are classified into the following categories:

- according to the degree of organisation of the matter, into material traces: (e.g. blood stains, fibers, fingerprints) and memory traces (e.g. the appearance of a person, the sound of a shot),
- according to the mechanism of formation, on: impressions (prints, marks) and stains,

- by type: originating e.g. from human skin (dermatoscopic traces), from tools (toolmarks), from footwear (shoe marks).

Among the dermatoscopic traces, the most frequent are marks of skin ridges, i.e. those generated by the impact of the fingertips and / or hands on the substrate. The quality and legibility as well as the possibility of visualizing fingermarks depends to a large extent on the amount and composition of the sweat and sebaceous (deposit-making) secretions transferred from the ridges of the papillae to the touched surfaces. The sweat-sebaceous substance covering the skin comes from the sweat and sebaceous secretory glands. Eccrine sweat glands are evenly distributed over almost the entire surface of the body and the majority of them are located on hands and feet. Apocrine sweat glands are located in the armpits, genital and excretory organs. There are sebaceous glands on the surface of the hairy skin, and fatty compounds are transferred to the surfaces of the hands when you touch the oily skin. The composition of the sweat and sebaceous secretions varies in terms of the content of various components. The main component of sweat is water, which makes up about 98%, the remaining ingredients include organic and inorganic compounds. The morphology of skin is shown in Figure 1.

The composition and quantity of sweat and sebaceous substance are not constant. The secretions of individual glands are found in various proportions. Their levels and compositions are influenced by factors, such as: diet, environment, emotional state or individual's age.

¹ <http://sjp.pwn.pl/haslo> (accessed on: 22.07.2020).

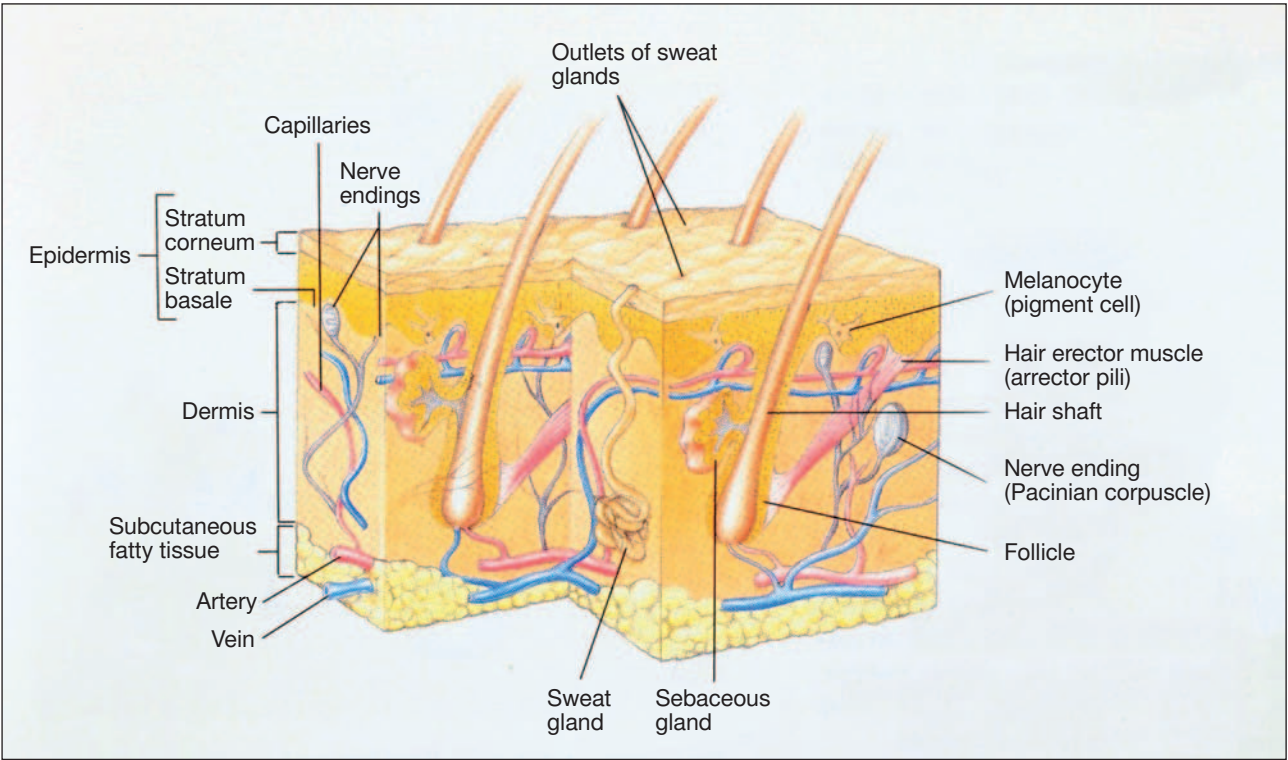


Fig. 1. Skin morphology.

Aim of the study

In this study, an attempt was made to determine the relationship between a person’s age and the amount of sweat and sebaceous substance. For this purpose, fingerprints left by donors on absorbent and non-absorbent substrates were subjected to the process of visualisation and the effectiveness of their detection was assessed.

Methodology

Seventy men and women of different ages (Figs. 2, 3, 4, 5, 6) made marks of all ten fingertips on the substrate made of plastic (non-absorbent background) and a sheet of photocopier paper

(absorbent background). The prints were made with the natural sweat and sebaceous substance. Before making marks donors washed their hands and performed their usual activities for 45 minutes, and only after that time they pressed their fingers to the substrate, trying to maintain the same pressure of fingertips on each substrate and the same contact time.

The marks made on the non-absorbent background were developed by cyanoacrylate polymerisation technique and, after that, Basic Yellow 40 fluorescent dye was applied. The marks left on the absorbent background were developed by DFO technique, and, subsequently ninhydrin was applied.

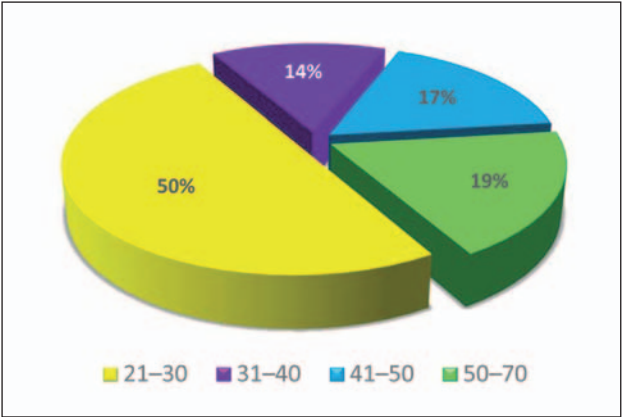


Fig. 2. Breakdown of donors by age in percentage terms.

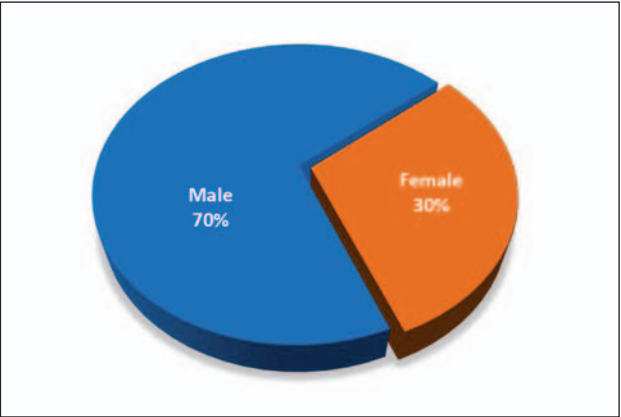


Fig. 3. Breakdown of donors by sex in percentage terms.

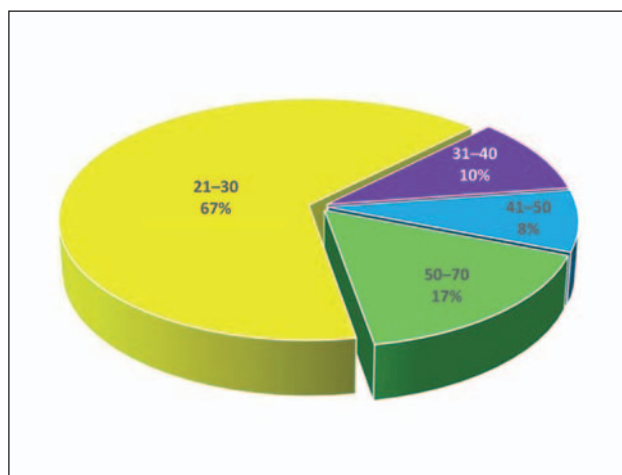


Fig. 4. Breakdown of male donor group by age in percentage terms.

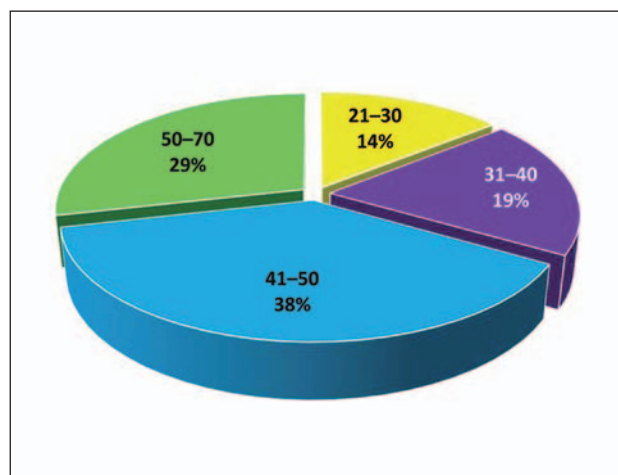


Fig. 5. Breakdown of female donors by age in percentage terms.

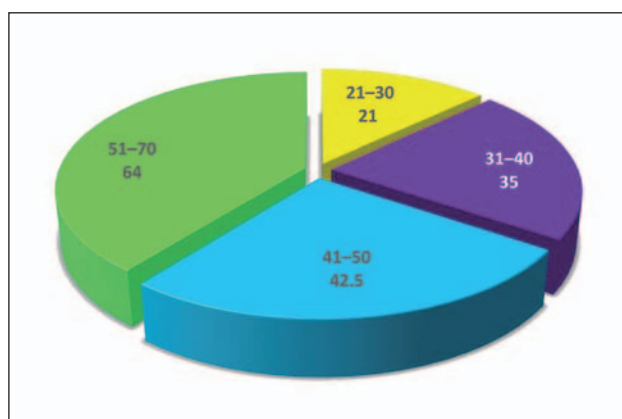


Fig. 6. Median of age in individual age groups.

Macroscopic examinations were carried out in light ranges appropriate for each of the techniques used, as follows:

- cyanoacrylate polymerisation – white light,
- Basic Yellow 40 – blue light of 415 nm wave length with use of an yellow viewing filter,
- DFO – blue-green light of 505 nm wavelength with use of an orange viewing filter,
- ninhydrin – white light.

The developed marks were evaluated in 0–1 scale after application of every technique:

- 1 – marks have been detected and they have been qualified as suitable for identification,
- 0 – no marks or marks unsuitable for identification have been detected.

Obtained results were recorded in spreadsheet.

Examination results

The footprint assessments recorded in the spreadsheets were statistically analysed. On its basis, people were divided into categories: A, B and C, i.e. those secreting

large, medium and small amounts of sweat and sebaceous substance.

The obtained results are presented below in a graphic form (Figs. 7–12).

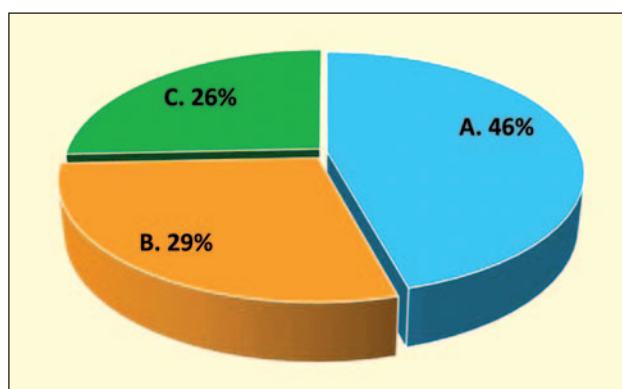


Fig. 7. Breakdown into categories in 21–30-year-old age group.

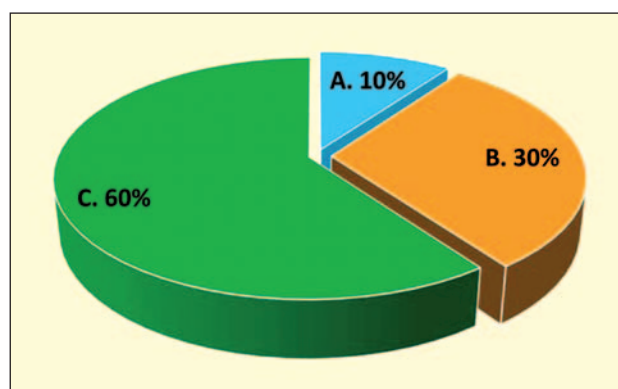


Fig. 8. Breakdown into categories in 31–40-year-old age group.

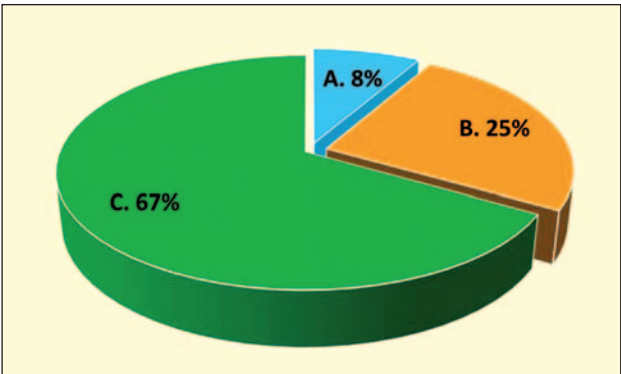


Fig. 9. Breakdown into categories in 41–50-year-old age group.

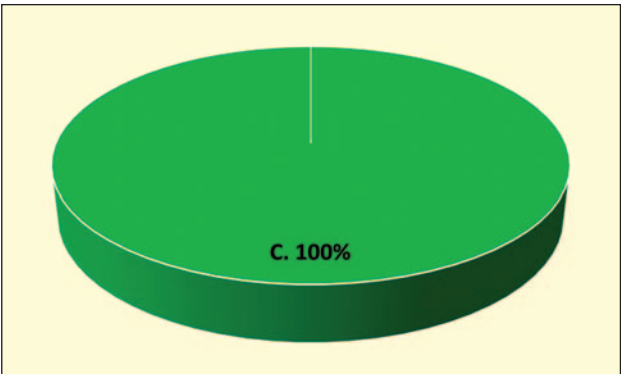


Fig. 10. Breakdown into categories in 51–70-year-old age group.

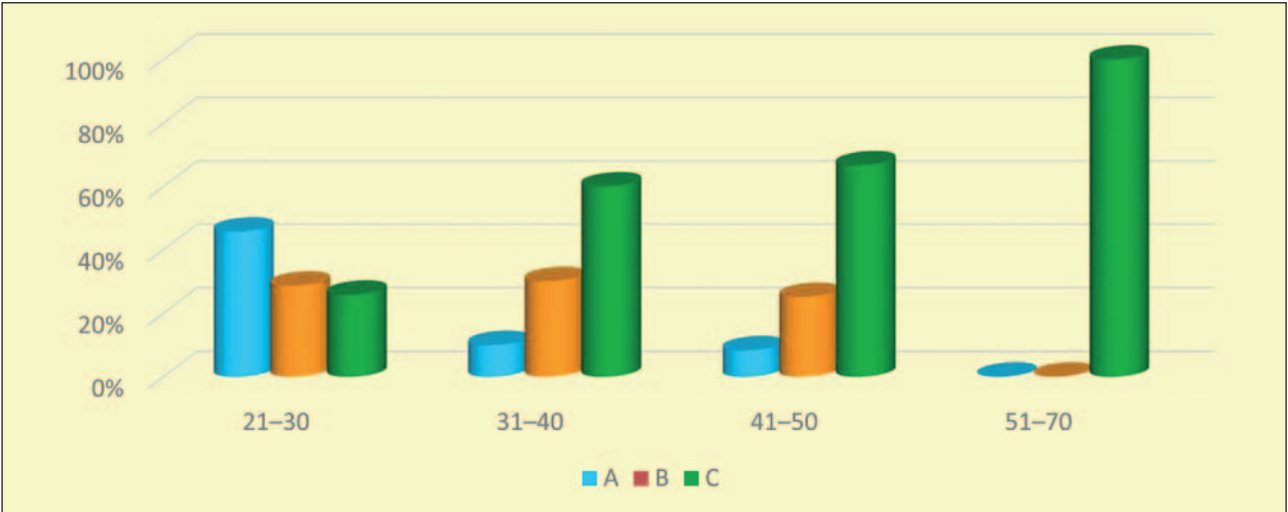


Fig. 11. Breakdown into categories in individual age groups.

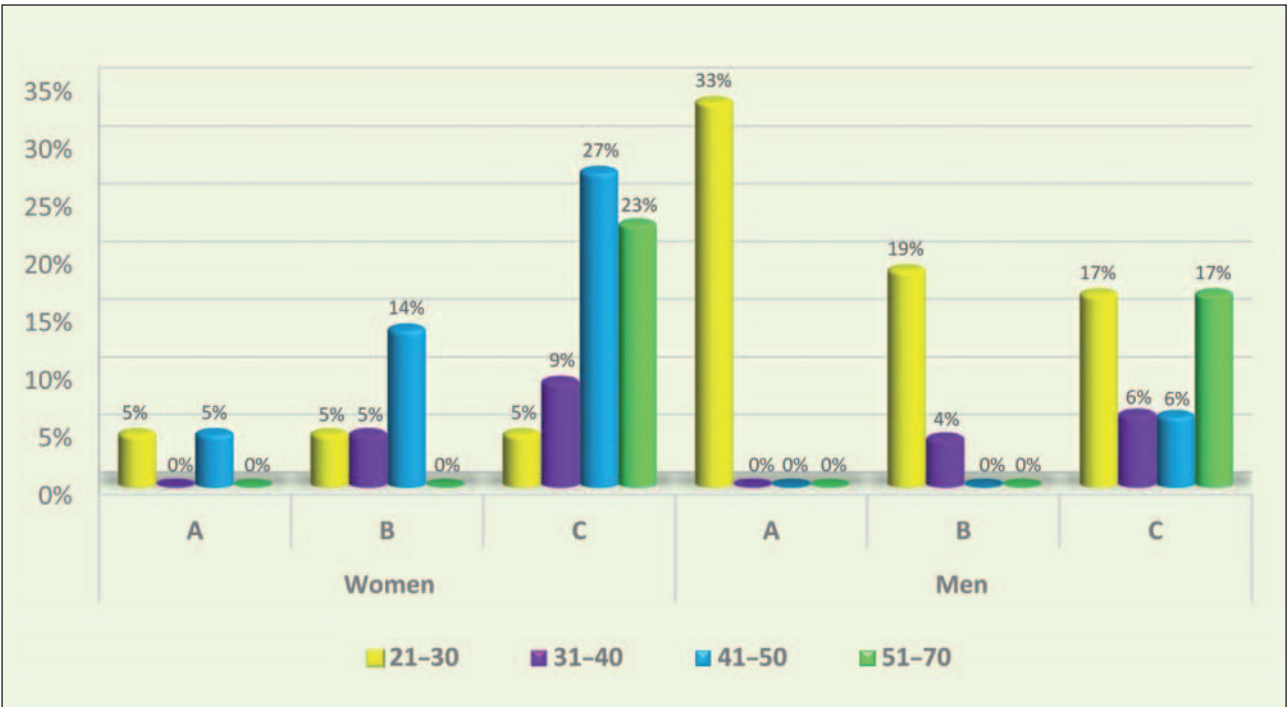


Fig. 12. Breakdown into categories by age and gender.

Summary

By summarising the research results obtained, it can be concluded that the amounts of sweat and sebaceous secretions decrease with person's age. People in the 21–30 age group secrete the greatest amount of sweat and sebaceous substances, while in the elderly the amount is very low. It certainly is connected with biological changes taking place in the body during different periods of life. Moreover, the amount of sweat and sebaceous secretions is greater in men than in women, which can also be explained by biological differences between the two sexes.

When planning to carry out e.g. validation of new examination techniques, proficiency tests or inter-laboratory comparisons that require preparation of test traces, it is possible to select persons who are representatives of specific categories of donors with a high degree of probability.

Sources of Figures

Figure 1: Solomon et al., 2020, p. 799

Figures 2–12: Authors

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