

ANNA BIERNASIUK, IZABELA KORONA-GŁOWNIAK, ANNA MALM

*The influence of selected factors describing the health state
of elderly people on the rate of colonization and carriage
of *Candida* spp. in the upper respiratory tract*

Wpływ wybranych czynników opisujących stan zdrowia osób w wieku podeszłym na kolonizację i nosicielstwo *Candida* spp. w obrębie górnych dróg oddechowych

INTRODUCTION

In most countries in Europe, including Poland, the percentage of people aged 65 years or older has increased every year, reaching at present above 10%. The problems of elderly people may be regarded in social and medical aspects. The major medical problem of elderly people may be increased susceptibility to opportunistic infections, usually endogenous in origin, caused by microorganisms belonging to the natural microflora. Yeasts from genus *Candida*, predominantly *C. albicans*, are a part of the normal microflora colonizing mucocutaneous areas, mainly within upper airways, gastrointestinal tract and vagina [2, 8, 10].

Increased susceptibility of elderly people to colonization and carriage of *Candida* spp. within the mucous membrane of the upper respiratory tract may be related to several predisposing factors, including the natural process of aging, immunosuppression dependent on age or chronic diseases (e.g. cancer or diabetes mellitus), atrophic changes in the mucous membrane, insufficient hygiene of the oral cavity and hands, diseases of the oral cavity, nutrient deficiency, frequent intake of antibiotics with a broad spectrum activity or steroids [3, 5, 6, 14].

The aim of this study was to estimate the influence of selected factors, describing the health state of elderly people on colonization and carriage of *Candida* spp. in the mucous membrane of the upper respiratory tract.

MATERIAL AND METHODS

The studied group of elderly people, staying at a care center or at home, consisted of 110 persons aged ≥ 65 years, including 84 (76.36%) women and 26 (23.63%) men. They or the personnel from the care center completed a questionnaire concerning the estimation of health state, including age, prevalence of

chronic diseases (e.g. recurrent infections of the respiratory tract, circulatory system diseases, diabetes mellitus, cancer, allergy), usage of dentures, physical activity, habits and hospitalization.

Samples were taken up with sterile cotton swabs from the throat and nostrils from the same person four times over one year (spring, summer, autumn, winter) and immediately streaked onto Sabouraud agar with chloramphenicol. Isolation and identification of *Candida* spp. was carried out by the biochemical microtests API 20 C AUX and ID 32 C (bioMérieux) on the basis of assimilation of various substrates.

Statistical analyses of the obtained results were made using nonparametric Fisher's test. The differences were considered as statistically significant when $p < 0.05$.

RESULTS

According to Table 1, the most frequently mentioned factors estimating the health state of the studied elderly people were: usage of dentures, circulatory system diseases, limited physical activity and respiratory tract diseases.

Table 1. Prevalence of selected factors describing the health state of elderly people

Factor	Number (%) persons (n = 110)
Respiratory tract diseases	28 (25.45)
Circulatory system diseases	83 (75.45)
Diabetes mellitus	15 (13.64)
Cancer or other malignant diseases	7 (0.64)
Hospitalization	16 (14.54)
Usage of dentures	85 (77.27)
Limited physical activity	47 (42.73)

In this paper at least one isolation of *Candida* spp. from the same person during the assayed period was defined as colonization, while at least twofold isolation – as carriage. The rate of colonization by *Candida* spp. of the upper respiratory tract in elderly people was 73.64%, while the rate of carriage – 53.64%.

Table 2. Influence of selected factors describing the health state of elderly people on colonization of *Candida* spp. in the upper respiratory tract

Factor	Number (%) persons		<i>p</i>
	Colonization (n = 81)	No colonization (n = 81)	
Respiratory tract diseases	22 (27.16)	6 (20.69)	0.623
Circulatory system diseases	63 (77.78)	20 (68.96)	0.451
Diabetes mellitus	9 (11.11)	6 (20.69)	0.216
Cancer or other malignant diseases	6 (7.41)	1 (3.45)	0.673
Hospitalization	14 (17.28)	2 (6.90)	0.229
Usage of dentures	67 (82.72)	18 (62.07)	0.037
Limited physical activity	29 (35.80)	18 (62.07)	0.017

As shown in Table 2, the usage of dentures was a significantly statistical factor predisposing to colonization by *Candida* spp. of the upper respiratory tract of elderly people ($p = 0.037$). In contrast, limited physical activity was a significantly statistical factor predisposing to decrease of colonization by *Candida* spp. in the upper respiratory tract of the studied people ($p = 0.017$). As presented in Table 3, limited physical activity was an important factor predisposing to decrease of carriage by these yeast in the upper respiratory tract of elderly people but without statistic significance ($p = 0.054$).

Table 3. Influence of selected factors describing the health state of elderly people on carriage of *Candida* spp. in the upper respiratory tract

Factor	Number (%) persons		<i>p</i>
	Carriage (n = 59)	No carriage (n = 51)	
Respiratory tract diseases	18 (30.51)	10 (19.61)	0.272
Circulatory system diseases	44 (74.58)	39 (76.47)	1.00
Diabetes mellitus	8 (13.56)	7 (13.73)	1.00
Cancer or other malignant diseases	4 (6.78)	3 (5.88)	1.00
Hospitalization	9 (15.25)	7 (13.73)	1.00
Usage of dentures	47 (79.66)	38 (74.51)	0.649
Limited physical activity	20 (33.90)	27 (52.94)	0.054

DISCUSSION

According to literature data [5, 6, 9, 10] *Candida* spp. may occur in 10–100% of healthy people within the mucous membrane of the upper respiratory tract, depending on various factors. Our data indicate that the usage of dentures was a statistically significant factor predisposing to colonization *Candida* spp. of the mucous membrane in the upper respiratory tract of elderly people. This is in agreement with literature data [4] that the prevalence of *Candida* spp. in the oral cavity and in the throat was 50–100% among persons with dentures. Moreover, the results of Batura-Gabryel and co-authors [3, 14, 15] showed that the usage of dentures was a statistically significant factor ($p < 0.03$) predisposing to oral candidiases.

The consequence of denture carrying is frequently damage of the mucous membrane of the oral cavity and inflammable state which may predispose to colonization by *Candida* spp., followed by candidial infections [1, 7]. Yeasts possess the ability of adhesion both to the mucous membrane of the oral cavity and to the solid base of prosthesis. These microorganisms penetrate to aperture in acrylic material of dentures and settle their surface [13]. Also insufficient hygiene of the oral cavity and dentures may be regarded as an additional factor predisposing to the increased occurrence of *Candida* spp. No saliva flow under dentures makes their natural cleaning, impossible but a decrease of pH under dentures from physiological pH 6–8 to pH 4–5 may enhance yeast adherence [13, 15].

According to our data, in the assayed population of elderly people limited physical activity was an important factor predisposing to a decrease of colonization and carriage of *Candida* spp. in the

upper respiratory tract. Moreover, other authors [11, 12] found that physical activity may reduce the risk of occurrence of upper respiratory tract infections due to its positive effect on the immune system.

CONCLUSIONS

Our results confirm that the usage of dentures was a significant risk factor predisposing to *Candida* spp. colonization in the upper respiratory tract of people aged ≥ 65 years. In contrast, limited physical activity was a significantly statistical factor predisposing to a decrease of colonization by *Candida* spp. in the upper respiratory tract of the studied elderly people.

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SUMMARY

An important problem of elderly people may be increased susceptibility to infections caused by *Candida* spp., usually endogenous in origin. The aim of this study was to estimate the influence of selected factors on colonization and carriage of yeasts in the mucous membrane of the upper respiratory tract in people aged ≥ 65 years. Isolation and identification of *Candida* spp. from swabs of the throat and nasal cavity were carried out on the basis the classical diagnostic tests. Our data indicate that the usage of dentures ($p = 0.037$) was a statistically significant factor predisposing to colonization of *Candida* spp. in the mucous membrane of the upper respiratory tract of elderly people. On the other hand, limited physical activity was a statistically significant factor predisposing to a decrease of colonization ($p = 0.017$) by *Candida* spp. in the upper respiratory tract of these people.

Keywords: elderly people, colonization, carriage, *Candida* spp., upper respiratory tract

STRESZCZENIE

Ważnym problemem osób w wieku podeszłym może być zwiększona podatność na zakażenia wywoływane przez *Candida* spp., które zazwyczaj mają charakter endogenne. Celem pracy była ocena wpływu wybranych czynników na kolonizację i nosicielstwo tych grzybów w obrębie górnych dróg oddechowych osób w wieku powyżej 65 roku życia. Izolację i identyfikację grzybów z wymazów z gardła i nosa prowadzono przy użyciu klasycznych metod diagnostycznych. Wykazano, że posiadanie protez zębowych ($p = 0,037$) było czynnikiem istotnym statystycznie predysponującym do kolonizacji błon śluzowych górnych dróg oddechowych przez drożdżaki. Natomiast ograniczona sprawność fizyczna była czynnikiem statystycznie istotnym sprzyjającym spadkowi kolonizacji ($p = 0,017$) drożdżaków w obrębie błon śluzowych górnych dróg oddechowych u badanych osób.

Słowa kluczowe: osoby w wieku podeszłym, kolonizacja, nosicielstwo, *Candida* spp., górne drogi oddechowe