INTRODUCTION

According to the WHO, more than a quarter of the Earth’s population suffers from mycosis, and mycotic lesions cause a variety of skin and mucosal diseases, often of severe and prolonged course, with frequent relapses [1,2,3]. Recently, Ukraine has also witnessed a significant increase in the incidence of mycoses, a tendency towards the development of complicated forms, which lead to the long-term labour capacity loss [4]. Sensitizing effect produced by mycosis agents on a body can cause mycosis eczema, allergic vasculitis, etc. [5].

Damages of skin, its appendages and visible mucous membranes by potentially pathogenic agents, i.e. Candida fungi, are commonly referred to as the “superficial candidosis”. These fungi are the part of the body normal microflora and are saprophytes found on skin, its appendages and mouth mucous membranes. In candidosis pathogenesis, factors of endogenous and exogenous nature contributing to the transformation of Candida from its vegetative form to the pathogenic one are distinguished [6,7,8]. At that, the crucial importance belongs to such endogenous factors as the age of patients, metabolic disorders, hypovitaminosis, the presence of common infections, chronic somatic and oncological diseases, various gastrointestinal pathologies, as well as side effects occurred due to the long-term use of antibiotics, corticosteroids [2,3].

The effect of such a factor as carbohydrate metabolism disorder on candidosis development should be noted separately since in hyper-glycaemia conditions yeast-like fungi intensively propagate actively using sugar for their own metabolic processes [5,9]. The carbohydrate metabolism disorder is testified by the of blood glucose concentration [10 11, 12], i.e. labile indicator reflecting the carbohydrate metabolism status at the time of the study. At that, for a diagnostic purpose, the level of fasting glycaemia and urine glucose is measured, and glucose tolerance tests are performed. However, the informativity of such tests is rather low, in particular, the level of blood glucose indicates glycaemia for the last 10-15 minutes, and the level of urine glucose – for over the past 5-6 hours [13,14,15]. In turn, changes in the rhythms of endocrine regulation at carbohydrate metabolism disorders often show an erroneous picture of improvement with repeated determinations of blood glucose concentration, which requires the use of additional tests of glucose tolerance [16].
THE AIM
To study the specific features of superficial candidosis course in respect of the skin and mucous membranes against the initial carbohydrate metabolism disorders or the presence of diabetes mellitus.

MATERIALS AND METHODS
To determine the parameters of carbohydrate metabolism and their effects on the superficial candidosis course we examined 93 patients with superficial candidosis aged 18-75 years including 32 (34.41%) males and 61 (65.59%) females. The control group consisted of 15 practically healthy persons, out of them 4 (26.67%) men and 11 (73.33%) women (Figure 1). The distribution of patients per the lesion clinical forms is presented in Table I.

The candidosis diagnosis was based on the anamnesis, results of clinical examinations and laboratory tests that included microscopic examination of scrapings from skin folds, oral mucosa and nail plates, as well as mycological (cultural and microscopic) studies.

The study of carbohydrate metabolism included determining the level of fasting glucose to detect the manifested diabetes mellitus, glucose tolerance test (with 75 g glucose load). In 32 patients, glucose intolerance was detected, therefore they were additionally determined by the level of glycosylated haemoglobin (Hb$_{A1c}$) and fructosamine (FR). The content of Hb$_{A1c}$ was determined through ion-exchange chromatographic method in whole blood. The content of FR was determined through colorimetric-kinetic method in serum and in blood plasma. Blood was sampled under fasting condition from the basilic vein, the study was carried out immediately after sampling. Sentinel CH test system by Interco (Italy) and spectrophotometer with a 405-425 nm filter were used to perform studies.

The study results were processed via generally accepted statistical methods.

RESULTS AND DISCUSSION
Diabetes mellitus is a major risk factor for fungal infections, and mortality increases when diagnosis and treatment of fungal infections are delayed in diabetic patients. The most common fungal infections in diabetic patients are candidiasis [7,8].

Manifestations of candidosis were detected in patients at different areas of their skin and visible mucous membranes, predominantly in the areas of large skin folds (60.22%), oral candidosis (16.13%), and candidosis of interdigital folds (12.90%). Less commonly, candidal paronychia of hand fingers and onychomycosis (9.68%) and candidal onychomycosis (5.38% among all the examined or in 16.80% men) were detected.

The performed studies have shown that in examined patients among the concomitant diseases various pathologies...
of endocrine (diabetes mellitus – in 15% of the examined, and among patients with excess body weight and obesity - in 36%) and cardiovascular systems (ischemic heart disease – in 14%, varicose lesions – 11%, arterial hypertension – in 15% of examined patients) predominated.

In patients under the age of 50, fasting glucose rates were within the normal range, and in patients aged 50-65 years and in patients older than 66 years, these rates were 4.15±0.24 mmol/L and 6.38±0.20 mmol/L, respectively. Also, among patients aged 50-65 years, 5 individuals were diagnosed with type 2 diabetes, in patients older than 66 years - 9 individuals.

According to the study results, it was established that in the control group all carbohydrate metabolism parameters were within the normal range (Figure 2).

The fasting glycaemia rates in patients with minimal and medium candidosis lesions were within the norm (3.80±0.015 mmol/L). In patients with major candidosis lesions and relapses the rates reached 3.93±0.024 mmol/L. In 15 patients with concomitant pathology in the form of diabetes mellitus the fasting glycaemia rates were 7.68±0.082 mmol/L. Thus, a comparative analysis of fasting glycaemia rates in patients with candidosis lesions affirmed that fasting glycaemia rates depend on the patients’ age and degree of lesion severity.

At the same time, due to the insufficient informativity of glycaemic testing additional study was required. In this case, patients with the confirmed diabetes mellitus underwent a glucose tolerance test upon having a trial breakfast. In patients with minimal and medium candidosis lesions the glycaemic rates of in 2 hours after intake of 75 g of glucose were 5.77±0.149 mmol/L, in patients with major candidosis lesions and relapses – 7.95±0.174 mmol/L (which allowed detecting latent diabetes mellitus in 13 patients for the first time), respectively. In the group of patients with candidosis and affirmed diabetes mellitus, glycaemic rates were the highest and amounted to 13.96±0.57 mmol/L.

The evaluation of the stability of carbohydrate metabolism disorders was determined via the degree of blood proteins glycosylation. It is known, that half-life of blood haemoglobin lasts about 120 days, during which it gradually becomes glycosylated. The high informativity of this test is determined by the independence of the Hb\textsubscript{A1c} level from exercises, dietary preferences, and the use of medicines, and it permits to record even minor carbohydrate tolerance disorders. Therefore, Hb\textsubscript{A1c} content is considered an integral characteristic of the glycaemic level for the past 3-4 months. The half-life period of the glycosylated albumin is 20 days, and the determination of fructosamine content in blood reflects the average level of glucose in blood over the last 2-3 weeks.

The study has shown that in the group of patients with candidosis lesions there is a direct dependence of Hb\textsubscript{A1c} and fructosamine on the disease severity. Thus, in patients with minimal and medium candidosis lesions an increase in Hb\textsubscript{A1c} and fructosamine values was observed as compared to the same rates in the control group by 1.54 and 1.21 times, respectively, in patients with major candidosis lesions and relapses the concentration of Hb\textsubscript{A1c} increased by 2.59 times, and FR – by 2.26 times in relation to the rates of the control group. Thus, we have justified a direct correlation between the degree of candidosis severity and the levels of glycosylated haemoglobin and fructosamine.

Hence, the detection of increased levels of glycosylated blood proteins indicates the pathogenetic importance of these processes in the development of candidosis lesions. The determination of Hb\textsubscript{A1c} and FR is a sensitive test that
can reliably detect individuals with diabetes mellitus and glucose intolerance among candidosis patients.

The detection of these correlation patterns is an important element in the development of a comprehensive pathogenetically valid treatment of patients with skin and mucous membrane candidosis lesions.

CONCLUSIONS

The results of the study have shown that in patients with anamnestic diabetes mellitus the clinical manifestations of candidosis were more pronounced than in those patients who did not suffer from this pathology. Superficial candidosis against the background of diabetes mellitus was of a disseminated course, characterized by intense itching and expressed inflammatory reaction, and eczematization and frequent relapses were observed.

In patients with minimal and medium candidosis lesions, glucose intolerance was not detected, and there was no correlation between $\text{Hb}_{\text{A1c}}$ and FR rates and the intensity of candidosis lesions. At the same time, there was a direct correlation between $\text{Hb}_{\text{A1c}}$ and FR rates and the intensity of candidosis lesions in patients with impaired glucose tolerance, which allows using it as an additional diagnostic criterion for early forms of diabetes mellitus. Therefore, as a result of the studies, there was an undoubted direct correlation between the degree of lesions in patients with superficial candidosis and $\text{Hb}_{\text{A1c}}$ and FR established.

REFERENCES


Authors’ contributions:
According to the order of the Authorship.
Conflict of interest:
The Authors declare no conflict of interest.

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