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The Serum Levels of Tumor Markers in the Elderly Population of Yakutia

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Abstract

The purpose of our research was to assess the level of tumor markers in the blood serum of elderly residents of Yakutia.

Material and Methods: We examined 204 elderly residents of Yakutia (52 men aged from 60 to 74 years and 152 women aged from 55 to 74 years). The study did not include the people who have oncological or preoncological diseases, or those with exacerbation of chronic diseases. Regarding ethnic origin, all examined people were Yakuts (indigenous people of Yakutia). The levels of tumor markers (AFP, CA 125, and PSA) in the blood serum were determined by ELISA.

Results: Among elderly people, the serum level of AFP was at higher levels within the reference range in single working people and people having a low level of education and/or obesity. The serum level of CA125 in women increased depending on ML, discomfort of housing, and low level of material well-being. The serum level of PSA was at higher levels within the reference range in male smokers. (*International Journal of Biomedicine. 2019;9(2):172-175.*)

Key Words: cancer antigen 125 • prostate-specific antigen • alpha-fetoprotein • reference range

Abbreviations

AFP, alpha-fetoprotein; **BMI**, body mass index; **CA 125**, cancer antigen 125; **ML**, marriage length **PSA**, prostate-specific antigen; **QL**, the quality of life.

Introduction

Tumor markers (TMs) are specific substances, usually proteins, that are produced by the body in response to cancer growth or by the cancer tissue itself. TMs are assuming a growing role in all aspects of cancer care, from initial screening to follow-up after treatment.^(1,2) TMs are also expressed by healthy fetal tissues and recognized as oncofetal. These antigens are associated with cell proliferation and differentiation. In pregnancy, they affect the maternal immune response, generating maternal tolerance toward the embryo, while in malignancy their biological role is to suppress the host's immune system.

TMs can also show up in certain non-cancerous conditions. So, CA125 level in the blood serum increases in patients with heart failure, endometriosis, and obesity.⁽³⁻⁶⁾ Megaloblastic anemia leads to a substantial increase of average CA15-3 value.⁽⁷⁾ The AFP level is significantly higher among people with metabolic syndrome, cirrhosis, hepatitis, ataxiatelangiectasia, nephritic syndrome, pregnancy and gastritis, in comparison with healthy people.⁽⁸⁻¹²⁾ Furthermore, the following factors can influence the level of TMs: age, addictions (smoking, alcohol), ecology, and socio-economic conditions.⁽¹³⁻¹⁵⁾ PSA is not a malignant, but a specific organ target marker; it means that the PSA level can be increased in the presence of nonmalignant conditions of a prostate, such as benign hyper trophy of prostate or prostatitis.⁽¹⁶⁾

TMs quantitatively reflect any damage to tissues and bodies demanding restoration of a cellular homeostasis. Thus, TMs are

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integrated indicators of the general state of health of the body.

We examined the elderly population of the Sakha Republic (Yakutia) [(SR(Y)], which lives in extreme climatic conditions in the North. Screening a population of elderly residents of Yakutia for TMs has never been conducted. In this regard, the purpose of our research was to assess the level of TMs in the blood serum of this population.

Material and Methods

We examined 204 elderly residents of Yakutia (52 men aged from 60 to 74 years and 152 women aged from 55 to 74 years). The study did not include the people who have oncological or preoncological diseases, or those with exacerbation of chronic diseases. Regarding ethnic origin, all examined people were Yakuts (indigenous people of Yakutia). To assess quality of life, we used the standard questionnaire (SF-36), modified by the lab of medical-social research in our institution.

BMI was calculated using Quetelet's formula (kg/cm^2). BMI value between $25 \text{ kg}/\text{m}^2$ and $29.9 \text{ kg}/\text{m}^2$ was assessed as overweight (pre-obesity), BMI value $\geq 30 \text{ kg}/\text{m}^2$ was assessed as obesity.⁽¹⁷⁾ The levels of TMs in the blood serum were determined by ELISA on a Multiskan FC microplate photometer (Thermo Fisher Scientific, USA) using the Vector-Best test systems (Russia).

The study was approved by the Ethics Committee of the Yakut Science Center of Complex Medical Problems. Written informed consent was obtained from each patient.

Statistical analysis was performed using SPSS (version 19.0). Baseline characteristics were summarized as frequencies and percentages for categorical variables and as mean \pm SEM for continuous variables. The Mann-Whitney (U Test) was used to compare the differences between the two independent groups. The Pearson's correlation coefficient (r) was used to determine the strength of the relationship between the two continuous variables. A probability value of $P < 0.05$ was considered statistically significant.

Results and Discussion

The choice of these TMs was based on an analysis of data in the literature: AFP, PSA, and CA125 are mentioned most often in non-cancerous conditions. The mean levels of PSA, CA125 and AFP in the blood serum of elderly inhabitants were $1.85 \pm 0.78 \text{ ng}/\text{ml}$, $5.89 \pm 0.84 \text{ ng}/\text{ml}$, and $5.90 \pm 0.91 \text{ IU}/\text{ml}$, respectively, which were within the reference range.

According to the results of the questionnaire, respondents were divided into 3 groups, depending on marital status: married (n=89), widowers (n=75), and single (n=40). Results of the research showed that the serum TM content in elderly people depended on their marital status. We found a decrease in the AFP level in the group of widowers and married people by 1.22 times and 1.79 times, respectively, in comparison with single people ($5.47 \pm 0.58 \text{ IU}/\text{ml}$ versus $6.68 \pm 1.74 \text{ IU}/\text{ml}$ ($P=0.049$) and $3.72 \pm 0.89 \text{ IU}/\text{ml}$ versus $6.68 \pm 1.74 \text{ IU}/\text{ml}$ ($P=0.035$), respectively) (Fig.1).

The PSA value was lower in widowers by 1.17 times, in comparison with single men ($1.73 \pm 0.62 \text{ ng}/\text{ml}$ vs. $2.04 \pm 0.85 \text{ ng}/\text{ml}$).

ng/ml). The PSA level in married persons did not differ from single men. The serum level of CA125 in women did not depend on marital status. Possibly, significant reduction in the content of AFP in married people can be explained by protection of health by buffering stress reactivity and encouraging healthy behavior.

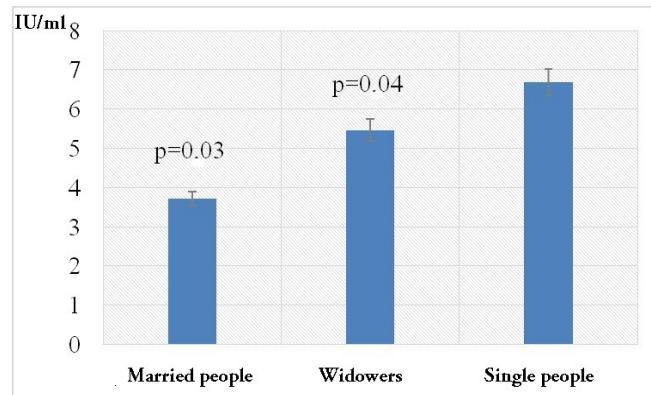


Fig.1. The serum level of AFP depending on marital status

The levels of TMs depended on the marriage length (ML). In groups of women with ML between 10 and 20 years (n=20), 20 and 30 years (n=35), and > 30 years (n=82), the serum levels of CA125 were as follows: $2.38 \pm 0.78 \text{ ng}/\text{ml}$ $5.47 \pm 0.80 \text{ ng}/\text{ml}$ and $6.46 \pm 1.32 \text{ ng}/\text{ml}$, respectively; $P < 0.05$ between (n=20) and (n=35). However, we found a weak positive correlation between ML and CA125 ($r=0.20$, $P=0.13$). In addition, average values of PSA and AFP did not differ with respect to ML.

From numerous references, it is known that QL of elderly people is associated with such factors as employment and education.⁽¹⁸⁾ The serum AFP level in persons with higher education (n=24) was 1.3 times lower ($4.89 \pm 0.15 \text{ IU}/\text{ml}$) than in persons with secondary education (n=148) ($6.36 \pm 0.23 \text{ IU}/\text{ml}$) ($P < 0.05$). Low levels of AFP in people with higher education can be explained by the presence of established concepts aimed at maintaining a healthy lifestyle.

The serum level of AFP in working people (n=51) was 1.35 times higher ($7.38 \pm 0.80 \text{ IU}/\text{ml}$) than in nonworking (n=153) people ($5.45 \pm 0.31 \text{ IU}/\text{ml}$) ($P < 0.05$). The levels of CA125 and PSA did not differ depending on education level (higher, secondary, and elementary) and employment status.

Type of housing had a significant impact on the level of tumor markers. In the women living in uncomfortable housing, the serum level of CA125 was 1.79 times higher ($6.04 \pm 0.87 \text{ ng}/\text{ml}$; $P=0.02$) than in women with comfortable housing ($3.44 \pm 0.79 \text{ ng}/\text{ml}$) (Fig.2). The levels of PSA and AFP did not depend on this factor.

According to the completed questionnaires, 83 respondents answered to a question of material well-being that they were well-off (Group A), 83 answered - means were enough for food and essentials (Group B), 32 - means were enough only for food (Group C), and 6 answered - means were not enough for food (Group D). According to our data, the serum levels of CA125 and AFP decreased depending on material well-being. Therefore, in Group B, the serum levels

CA125 and AFP were 1.51 and 1.42 times higher (6.61 ± 0.49 ng/ml; $P=0.026$; 8.10 ± 1.15 IU/ml) than in Group A. Thus, in Group C, the serum levels of CA125 and AFP were 2.13 and 1.35 times higher (9.33 ± 1.33 ng/ml [$P=0.03$] and 17.68 ± 1.76 IU/ml), respectively, than in Group A (CA125 – 4.38 ± 0.67 ng/ml; AFP – 5.69 ± 1.26 IU/ml). The PSA level did not depend on material well-being. Among the interviewed elderly people, 173 were non-smokers and 29 - long-term smokers. In smokers, we found a significant increase in the PSA level by 4.6 times in comparison with non-smokers 6.62 ± 1.44 ng/ml vs. 1.44 ± 0.01 ng/ml, $P<0.05$) (Figure 3). However, the literature data on this question are contradictory.

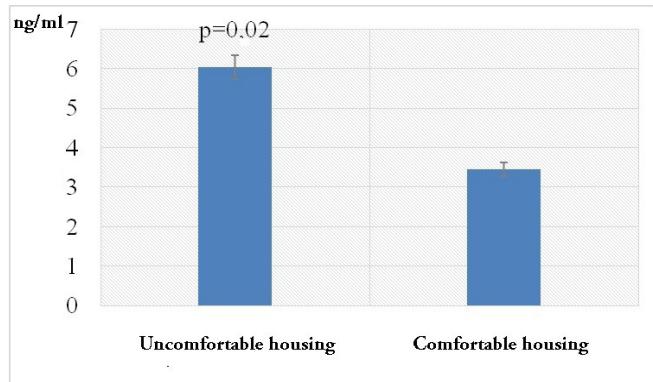


Fig. 2. The serum level of CA125 and type of housing.

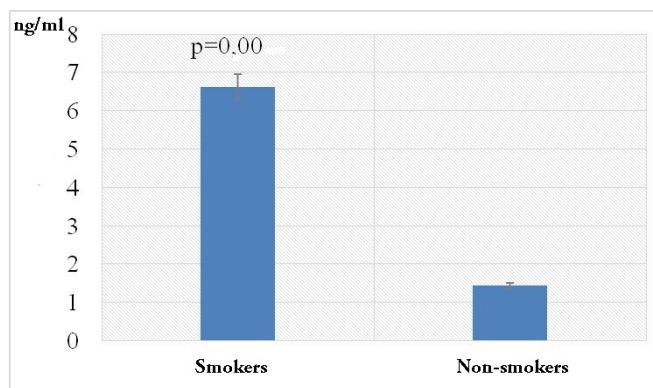


Fig.3. The PSA level in the blood serum of smokers and non-smokers

Multivariate linear regression analysis in the study by J.Li⁽¹⁹⁾ showed that total PSA was 7.9% and 12.2% lower among current and former smokers, respectively, than among never smokers. In the study by G.Kog et al.,⁽²⁰⁾ the PSA level was higher in smokers compared to nonsmokers, although it was not statistically significant.

In the circumstance of severe climatic conditions, 155 respondents had a sedentary lifestyle for a longer time during the year, and only 49 engaged in physical culture and sports. The levels of PSA, SA125 and AFP in elderly people not engaged in physical culture were 3.55 (1.98 ± 0.21 ng/ml), 1.5 (5.98 ± 0.71 ng/ml) and 4 (7.10 ± 0.51 IU/ml) times higher, respectively, than in elderly people engaged in physical activity (PSA – 0.56 ± 0.50 ng/ml, CA125 – 4.02 ± 0.41 ng/ml, AFP – 1.77 ± 0.39 IU/ml).. Thus, regular physical activity may be an important factor in stabilizing the level of the investigated TMs.

Consumption of unbalanced, high-calorific food by elderly people and insignificant physical activity in wintertime (6-7 months a year) promotes metabolic disorders with increasing BMI. We found a normal BMI in 77 cases, overweight in 65, and obesity in 62 cases. The AFP level depended on BMI. With $BMI < 25$ kg/m², the AFP level was 3.16 ± 0.50 IU/ml. In persons with overweight and obesity, the AFP level was 1.64 and 2.12 times higher than in persons with normal body weight (5.16 ± 1.03 IU/ml and 6.68 ± 0.62 IU/ml vs. 3.16 ± 0.50 IU/ml, $P<0.05$). Therefore, obesity had a great influence on the AFP level. Y. Chen et al.⁽⁹⁾ found a significant association between alpha-fetoprotein and metabolic syndrome in a Chinese asymptomatic population. Authors proposed that oxidative stress and oval cell proliferation were responsible for the elevation of serum AFP levels in patients with metabolic syndrome.

The serum levels of CA125 and PSA were not associated with BMI ($r=0.017$ and $r=0.121$, respectively). Despite the lack of reliable links between PSA and BMI in our study, there is evidence in the literature that obese males have a lower PSA level in blood serum.^(19,21)

Thus, among elderly people of RS(Y), the serum level of AFP was at higher levels within the reference range in single working people and people having a low level of education and/or obesity. The serum level of CA125 in women increased depending on ML, discomfort of housing, and low level of material well-being. The serum level of PSA was at higher levels within the reference range in male smokers.

Competing Interests

The authors declare that they have no competing interests.

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