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MEDICAL AND SOCIAL FACTORS AFFECTING OVERWEIGHT, OBESITY AND EATING BEHAVIOR OF STUDENT YOUTH AND DEVELOPMENT OF MEASURES FOR THEIR PREVENTION

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TABLE OF CONTENTS

INTRODUCTION

Relevance of the research topic

The prevalence of overweight and obesity has been increasing among all age groups both in the world and in the Russian Federation (RF) (Alferova V.I., 2022; Achkasov E.E., 2016; Balanova Yu.A., 2023; Goryunova M.V.,2019; Kosobutskaya S.A., 2019; Salikhova A.F., 2012; Tsydenova Ya.S., 2014; Shalnova S.A., 2017; Blüher M., 2019; WHO. Obesity and overweight [Electronic resource], 2021; WHO. World health statistics 2021: monitoring health for the SDGs, sustainable development goals, 2022). A national study conducted in the adult population of the Russian federation from 2020-2022 have shown that the prevalence of overweight was 44.0% and 33.7%, obesity was 30,0 % and 39,5% among men and women, respectively. This study indicated that the prevalence of obesity was higher among women (Balanova Yu.A., 2023).

Overweight and obesity also affect the health of university students Kegadueva D.A., 2018; Mengist G.A., 2022; Rubanenko O.A., 2018; Peltzer K., 2014; Pengpid S., 2015). A systematic review conducted in 2022 have shown that the prevalence of overweight and obesity among university students was 17.0% and 4.2%, respectively (Mengist G.A., 2022).

University students are especially vulnerable to unhealthy eating habits. Research has shown that most university students consume high amounts of fat and added sugar and low amounts of fruits and vegetables (Lopatin N.A., 2017; Solodovnikova Yu.V., 2017; Vasilyeva M.V., 2017; Aluf O.B., 2014; Drozhzhina N.A., 2013). Unhealthy nutrition and low levels of physical activity contribute to overweight and obesity (Tjatenkova N.N., 2020; Bryant E.J., 2019; Baranova O.B, 2005; Razina A.Oh., 2018; Bubnova M.G., 2016).

University students are prone to unhealthy eating practices for a variety of reasons. First, students may lack the knowledge to make healthy food choices. Second, university students may face financial difficulties and choose to consume unhealthy foods since healthier foods tend to be more expensive than unhealthy foods. Third, students also face

intense academic pressures, which can cause stress and change eating habits. Fourth, students' accommodations or changes in the living conditions may also influence their food preferences (Onishchenko G.G., 2018; Kuchma V.R., 2017; Agadzhanyan N.A., 2015; Minibaev T.Sh., 2012; Baranov A.A., 2007; Kazin E.M., 2014; Chubarovsky V.V. ., 2017). As a result, the overall morbidity rate among university students has increased by 37% over the past ten years, with unhealthy diets being the main contributing factor (Baranova O.V., 2005).

Therefore, in order to address the problem of overweight, obesity and eating behavior among university students, it is necessary to assess the regional characteristics of medical and social factors affecting these conditions.

The degree of development of the research topic

Youths, especially university students, are tomorrow's adults. Youth nutrition predicts the nutritional status of adults and offers opportunities to prevent the risk factors for diet-related non-communicable diseases (NCD), such as overweight and obesity. Eating habits and preferences formed in childhood and adolescence affect health and physical condition in adulthood. Some adults develop healthy habits from an early age, such as a balanced diet and regular exercise that help them stay healthy as they age. Others continue to be overweight as adults, which is harmful to their health. However, it is not too late to change course and develop more effective nutrition and lifestyle solutions for university students (Pogozheva A.V., 2020;Amoore B.Y., 2023; Govyazina T.N., 2017; Menges, G.A., 2022; Mengist G.A., 2024; Posokhova N.V., 2015;Navarro-Prado S., 2017; Yolcuoğlu İ.Z., 2022).

In this regard, protecting the health of university students is one of the most important responsibilities of society, since they constitute the intellectual and socio-economic potential of the nation (Gareeva I.A., 2020; Liga M.B., 2014; Mengist G.A., 2024). The study of overweight and obesity should be approached as a complex problem as they are influenced by a number of factors (Alferova V.I., 2022; Baranova O.V., 2005;

Kosobutskaya S.A., 2019; Lopatina R.F., 2017; Makeeva E.V., 2019; Meshenina N.V., 2020; Tolmachev D.A., 2019; Chizhkova, M.B., 2020; Blüher M., 2019).

However, there are limited studies on medical and social factors affecting overweight, obesity and eating behavior of university students in RF in general and in the study area in particular (Aminova O.S., 2017; Rubanenko O.A., 2018). In addition, since the RF is a demographically diverse country, it is unlikely that eating behaviors and other lifestyle choices found in one part of the country will be the same as in other regions (Navrotsky A.E., 2021; Lukmanova A.I., 2018; Aminova O.S., 2017; Lyapin V.A., 2014; Rubanenko O.A., 2018).

The high medical and social significance of this problem for the theory and practice of public health and healthcare organization served as the basis for conducting this study.

Purpose of the study

To assess medical and social factors affecting overweight, obesity and eating behavior of student youth, and scientifically substantiate measures for their prevention.

Objectives of the study

1. To analyze the levels and dynamics of non-communicable diseases related to nutrition among the population of the Russian Federation, the Republic of Sakha (Yakutia) and NEFU students based on data from Rosstat, the Ministry of Health of the Republic of Sakha (Yakutia) and the NEFU clinic for 2020-2022.
2. To identify medical and social factors associated with overweight and obesity among student youth (on the example of NEFU).
3. To determine medical and social factors associated with eating behavior of student youth (on the example of NEFU).
4. To develop and scientifically substantiate preventive measures to reduce overweight and obesity among student youth.

Scientific novelty of the research

New data on the levels and dynamics of non-communicable diseases related to nutrition among student youth (on the example of NEFU), the population of the Russian Federation and the Republic of Sakha (Yakutia) were obtained.

For the first time, medical and social factors associated with overweight and obesity among student youth (on the example of NEFU) have been identified.

For the first time, medical and social factors associated with the eating behavior of student youth (on the example of NEFU) have been determined.

New preventive measures have been developed to reduce overweight and obesity among student youth (on the example of NEFU).

Theoretical and practical significance of the work

Based on a statistical analysis of medical and social factors influencing obesity, overweight and eating behavior, key medical and social factors influencing these conditions were identified. This made it possible to develop a system of priority medical and social preventive measures to reduce overweight and obesity among student youth.

The developed methods for the prevention of overweight and obesity are intended to provide information to developers and implementers of university programs for making informed decisions on the prevention of overweight and obesity among student youth.

Implementation of research results

The results obtained during the dissertation work were introduced into the educational and pedagogical process of the Department of Health Organization and Preventive Medicine of the Medical Institute of M.K. Ammosov North-Eastern Federal University (NEFU) of the Ministry of Education and Science of the Russian Federation (act of implementation dated 25.03.2024).

Methodology and research methods

The study was conducted on the basis of systemic and interdisciplinary methodological approaches using the works of domestic and foreign researchers. To achieve the goals and objectives of the study, the methods of bibliographic, information search, system analysis, sociological (survey), statistical were used. The data collected during the survey were analyzed using both parametric and non-parametric statistical methods, including chi-square test, correlation analysis and regression analysis.

Provisions for defense

The main provisions submitted for defense:

1. According to official statistics (for 2020-2022), primary incidence of non-communicable diseases related to nutrition (morbidity of neoplasms, diseases of the endocrine system, circulatory system, digestive system and genitourinary system) among the entire population of the RF and the Republic of Sakha (Yakutia)) (RS(Y)) (per 1000 population) had an increasing trend. On the other hand, according to the NEFU clinic, the frequency (pathological incidence) of these diseases among NEFU students (per 1000 students examined) had a fluctuating trend. This indicates the need to strengthen organizational strategies for the prevention of these non-communicable diseases.

2. Gender, age, nutritional attitudes, food preferences, restrictive eating behavior, psychological distress, social support and level of physical activity were significantly associated with overweight and obesity among NEFU students, which indicates the need to address these issues.

3. There was a positive correlation between the three categories of eating behaviors, namely external eating behavior (ExEB), restrictive eating behavior (REB), and emotional eating behavior (EmEB), which indicates that any recommendation to promote healthy eating behavior should take into account the three types of eating behaviorS. “Institute of study”, “year of study”, “body mass index” (BMI), “ExEB”,

“EmEB” and “physical activity” were significantly associated with “REB”. “Gender”, “ExEB”, “REB” and “mean psychological distress score” were significantly associated with “EmEB”. “Satisfaction with NEFU services”, “REB”, “EmEB” and “Sleep duration” were significantly related to “ExEB”.

4. The methods developed for the prevention of overweight and obesity are designed to provide information to developers and implementers of programs to make informed decisions on the prevention of these phenomena in students.

Degree of reliability of the results obtained

The degree of reliability of the dissertation work is confirmed by the use of verified information sources and official statistics, the use of a pre-tested and validated questionnaire, the representativeness of the study participants and the use of various statistical methods of data analysis, as well as the involvement of the author at each stage of the research process. Quantitative characteristics are presented in the form of relative values and confidence intervals. The confidence level for hypothesis confirmation was greater than 95%. To ensure the representativeness of the survey data and assess the level, dynamics and size of the phenomenon being studied, the size of student samples was calculated using the formula of Daniel W.W., 1999 [153]. The results of the descriptive statistics of the study were processed using IBM Statistical Package for Social Sciences (SPSS) (version 23.0).

In addition, the provisions, conclusions and recommendations of the study are based on evidence, as shown by the tables and figures included in the results of the study.

Approbation of the research results

The main results of the study were presented and discussed at the following Congresses and conferences: XII National Congress with international participation “Ecology and human health in the North” (Yakutsk, November 2021), XVI Scientific and educational conference “Topical issues of preventive medicine” (Yakutsk, March 2022),

All-Russian conference with international participation "Integration of sciences: interdisciplinary in medicine" (Yakutsk, June 2022), interregional scientific and practical conference "Current problems of public health and healthcare" (Yakutsk, February 2023), I All-Russian conference with international participation “Public health, sociology and healthcare organization: integration of science and practice” (Yakutsk, June 2023), IX International scientific congress on physical education “Content, focus, methodology, organization”, dedicated to the 100th anniversary of state regulation of the physical education movement in Russia and the 100th anniversary of the physical education movement in the Republic of Sakha (Yakutia)" (Yakutsk, October 2023), republican scientific conference “Postgraduate Readings-2023” (Yakutsk, November 2023).

The dissertation was approved at the interdepartmental conference of the Medical Institute of the Federal State Autonomous Educational Institution of Higher Education “M.K. Ammosov North-Eastern Federal University” of the Ministry of Science and Higher Education of the Russian Federation (Protocol № 9 of 17.04.2024).

Author's personal contribution to the study

The author independently conducted a search and analysis of domestic and foreign literature on the topic of the dissertation. The author formulated the purpose and objectives of the study. The author independently collected, analyzed and interpreted the data. The author formulated the conclusions and practical recommendations of the study, and also developed preventive measures to reduce overweight and obesity among student youth. The author independently prepared reports and presentations on the topic of the dissertation for presentations at scientific and practical conferences. The author personally participated in the writing and publication of the research results.

Relationship of the work with scientific programs

The dissertation was carried out in accordance with the research plan of the Medical Institute of the Federal State Autonomous Educational Institution of Higher Education

"M.K. Ammosov North-Eastern Federal University" of the Ministry of Education and Science of Russia within the framework of the Problem "Habitat, occupational medicine and health status", the research topic "Development of scientific foundations for managing public health, taking into account the peculiarities of the socio-economic development of the region."

Publications on the topic of the dissertation

On the topic of the dissertation, 5 scientific papers have been published, including 4 scientific articles in journals included in the list of leading peer-reviewed scientific journals recommended by the Higher Attestation Commission of the Russian Federation, 1 textbook.

Main scientific results

During the dissertation research, a number of scientifically significant theoretical and practical results were obtained.

1. Based on the study of medical and social factors affecting overweight and obesity among student youth, eight medical and social factors (gender, age, attitude towards nutrition, food preferences, restrictive eating behavior, psychological distress, social support and physical activity) were identified as determinants that influence overweight and obesity among student youth [71;73, p. 8-9].

2. It has been shown that there is a positive correlation between the three categories of eating behaviors: restrictive eating behavior, emotional eating behavior, and external eating behavior. It has been revealed that restrictive eating behavior and BMI have a positive correlation. It has also been indicated that BMI and age are positively correlated [74, p. 7-8].

3. Based on the study of medical and social factors affecting restrictive eating behaviors of student youth, six medical and social factors (institute of study, year of study, body mass index, emotional eating behavior, external eating behavior and physical

activity) were identified as determinants that influence restrictive eating behavior of student youth . It has been shown that gender, restrictive eating behavior, external eating behavior and mean psychological stress score are identified as the determinants that influence emotional eating behavior of student youth. It has been demonstrated that satisfaction with NEFU services, restrictive eating behavior, emotional eating behavior and sleep duration are identified as the determinants that influence external eating behavior of student youth [74, p.7-8].

4. Based on an independent sample t-test analysis, the mean scores of emotional eating behavior and external eating behavior were higher among female students. It has been shown that the mean BMI score was higher among male students. It has been demonstrated that mean psychological distress score was higher among female students [74, p.7-8].

Compliance of the dissertation with the passport of the scientific specialty

The dissertation work corresponds to the passport of the scientific specialty 3.2.3 - “Public health, organization and sociology of healthcare, medical and social expertise”, in particular, paragraph 3 “Research of theoretical and practical problems of population health protection, determination of patterns of formation of population and group health”, paragraph 8 “Studying the role of socio-hygienic factors in the formation of health of certain homogeneous groups of population in order to develop health improvement programs and measures to improve the preventive direction of the health care system” and paragraph 9 “The lifestyle of certain groups of the population and its importance in shaping the health of the population. Study of quality of life and health, determination of criteria for assessing quality of life. Development of preventive programs for improving the health of the population using recommendations for a healthy lifestyle”.

Structure and scope of the dissertation

The dissertation, consisting of an introduction, five chapters, conclusion, conclusions, practical recommendations, list of abbreviations, list of terms and definitions, bibliography and appendices, is presented on 155 pages of typewritten text. The dissertation contains 53 figures and 21 tables. The list of references contains 278 references, including 159 scientific works by foreign researchers and 119 scientific works by domestic researchers.

CHAPTER 1. CURRENT STATE OF THE PROBLEM OF OVERWEIGHT AND OBESITY AMONG STUDENT YOUTH (LITERATURE REVIEW)

1.1 Overweight, obesity and eating behavior among university students

Overweight and obesity are defined as abnormal or excessive accumulation of fat in the body, which can impair health. BMI is a simple and commonly used index to classify people as overweight or obese. BMI (kg/m^2) is defined as a person's weight in kilograms divided by the square of height in meters. According to the World Health Organization , the BMI categories for adults are: BMI <18.5 kg/m2 for underweight; BMI 18.5–24.9 kg/m^2 for normal weight; BMI 25.0–29.9 kg/m^2 for overweight and BMI ≥30 kg/m2) for obesity [23, 168, 268].

Eating behavior is a complex interaction of genetic, physiological, psychological and social factors that can influence food preferences, meal timing and quantity of food consumed [175]. ExEB, EmEB and REB are the three main categories of eating behavior [261]. EmEB - is overeating in response to emotional states such as depression, anxiety, fear, anger or loneliness. REB is defined as the tendency to consciously limit food intake in order to lose weight or prevent weight gain. However, REB is associated with weight gain because it can lead to increased hunger and appetite. ExEB refers to overeating in response to external food cues such as sight, smell and taste, as well as social cues [175,209, 261,262]. Eating behavior problems have been reported to be associated with overweight or obesity [42, 51, 80, 97,116, 209].

University students are specific social groups that are vulnerable to numerous health risks during their studies, many of which affect the quality and length of life [4,118,119]. Admission of students to higher education institutions is characterized by students' adaptation to new life and social conditions, which are expressed in changes in the students' lifestyle. This can interfere with the biological, social and physical development of students and can make these individuals vulnerable to unhealthy lifestyles and health problems throughout their lives [25, 28, 30, 32,33,38,50,99]. Research has shown that there is a decrease in the number of healthy university students, an increase in

the percentage of chronic NCDs, and an increase in the percentage of students with disabilities. The decline in student health has detrimental consequences, such as decreased academic performance and productivity [29, 41].

Therefore, more research on the medical and social factors affecting overweight, obesity, eating behavior among university students is still needed to provide relevant information and encourage decision makers to prioritize action.

1.2 Prevalence of overweight and obesity among university students

There are regional differences in the prevalence of overweight and obesity among university students around the world. In South America, a higher prevalence of overweight and obesity was observed among university students. A cross-sectional study conducted among university students in Peru found that the prevalence of overweight and obesity was 26.1% and 6.2%, respectively [148]. Another study conducted among university students in Brazil found that the prevalence of overweight and obesity was 26.4% and 7.8%, respectively [164].

Regional variations were also evident in the prevalence of overweight and obesity among university students in Africa. A study conducted among university students in Botswana found that the prevalence of overweight and obesity was 24.9% and 11.9%, respectively [240]. A similar study conducted among university students in Cameroon found that the prevalence of overweight and obesity was 21.7% and 3%, respectively [162]. Another study conducted among university students in Ghana found that the prevalence of overweight and obesity was 20.4% and 5.5%, respectively [228]. A similar study conducted among university students in Morocco also found that the prevalence of overweight and obesity was 14.8% and 1.6%, respectively [138]. Additionally, a study conducted among Egyptian university students found that the prevalence of overweight and obesity was 28.9% and 11.8%, respectively [172].

In European countries, the prevalence of overweight and obesity among university students is also a public health problem. A cross-sectional study conducted among 210 university students in Bosnia and Herzegovina found that the prevalence of overweight

and obesity was 22.4% and 2.4%, respectively [221]. Another study conducted among 236 university students in Slovakia found that the overall prevalence of overweight and obesity was 40.9% [169]. A similar study conducted among 405 university students in Greece found that the prevalence of overweight and obesity was 16% and 1.2%, respectively [203]. A study conducted among 2258 university students in Turkey found that the prevalence of overweight and obesity was 4.4% and 0.6%, respectively [134]. Another study conducted among 503 university students in Turkey have shown that the prevalence of overweight was 17.3% [244].

The prevalence of overweight and obesity among university students has also been assessed in different regions of Asia. A cross-sectional study conducted among 448 private university students in Yemen found that the prevalence of overweight and obesity was 29.5% and 4.7%, respectively [123]. A second study conducted among 416 university students in Saudi Arabia found that the prevalence of overweight and obesity was 20.4% and 14.9%, respectively [253]. Another study conducted among 126 university students in Malaysia found that the prevalence of overweight and obesity was 25.4% and 9.5%, respectively [241]. A survey conducted among 800 university students in India found that the prevalence of overweight and obesity was 26.8% and 10.7%, respectively [231]. Another cross-sectional study conducted among 60 university students in India found that the prevalence of overweight was 11.66% [238]. A cross-sectional study conducted among 432 university students in Pakistan found that the prevalence of overweight and obesity was 10.2% and 3.7%, respectively [190]. Another cross-sectional study conducted among 272 university students in Pakistan also found that the prevalence of overweight and obesity was 27.6% and 5.5%, respectively [246]. A survey conducted among 385 university students in Iran found that the prevalence of overweight and obesity was 13.1% and 2.4%, respectively [214]. Another survey conducted among 1546 university students in Japan found the prevalence of overweight to be 7.2% [225]. A study conducted among 2313 university students in China found that the prevalence of overweight and obesity was 8.5% and 2.1%, respectively [157]. Another study conducted among 11,673 university students in China found that the prevalence of overweight and obesity was 7.3% and 2.2%, respectively [191]. A study conducted among 550 study participants in

Tajikistan found that the prevalence of overweight and obesity was 20.1% and 2.3%, respectively [87]. Another study conducted among 150 university students in Tajikistan found that the prevalence of overweight and obesity was 23.3% and 2%, respectively [86].

In the RF, the prevalence of overweight and obesity among university students also has regional differences. A cross-sectional study conducted among 379 students at Yaroslavl State Medical University found that 10% of women and 18% of men were overweight and obese, respectively [7]. Another study conducted among 278 university students in Samara and Kemerovo, RF, found that the prevalence of overweight and obesity was 12.2% and 4%, respectively [93]. A similar study conducted among 40 first and second year ethnic Altai students showed that 12.5% of them were overweight and obese [81].

1.3 Factors affecting overweight and obesity among university students

Overweight and obesity are multifaceted diseases caused primarily by the interaction of genes (nature) and the environment (nurture) [16, 53, 58, 82, 83, 96, 102, 107,166]. The term “gene-environment interaction” refers to how a person's genotype influences how they respond to environmental stimuli. In other words, the environment can influence and modify the genotype, while genes confer susceptibility [14,237,267].

Although overweight and obesity result from the interaction of genetics and environmental factors, environmental factors such as diet and lifestyle are major risk factors for the development of overweight and obesity [15, 55]. Therefore, overweight and obesity are primarily caused by an energy imbalance between calories consumed and calories burned. In other words, overweight and obesity are the result of either excessive consumption of high-calorie foods high in fat and sugar or decreased physical activity [35, 36, 62, 71, 84, 102].

Some of the common risk factors that may contribute to the development of overweight and obesity among university students are listed below.

1.3.1 Socio-demographic and economic factors affecting overweight and obesity among university students

Gender is one of the sociodemographic risk factors for overweight and obesity among university students, despite conflicting results from various studies. Cross-sectional studies conducted in the RF [7], Peru [148], Botswana [240], Bosnia and Herzegovina [221], Greece [203], Yemen [123], Japan [225] and Malaysia [234] showed that male university students had a higher risk of developing overweight and obesity compared to female university students. On the other hand, studies conducted in Cameroon [164], Morocco [138], Slovakia [169] and India [238] have shown that female university students have higher odds of being overweight and obese compared to male university students.

Age of university students was also another predictor of overweight and obesity among university students. A cross-sectional study conducted among university students in Botswana [240] found that the prevalence of overweight and obesity increased with age. Another study conducted in Yemen [123] also found that the prevalence of overweight and obesity increases with age. Similarly, a study conducted among university students from 22 countries found that the prevalence of overweight and obesity increased with age [230].

Regarding the ethnicity of university students, a cross-sectional study conducted among university students in the United States of America (USA) found that black and Hispanic university students had higher odds of being overweight and obese compared to white university students. This study also found that Asian university students were least likely to be overweight and obese [243].

Regarding the relationship between religion and overweight and obesity, a study conducted at the University of Granada in Melilla, Spain found that Christian students had a higher prevalence of overweight and obesity than Muslim students. This study found that Christian students consumed more total cholesterol, alcohol, saturated fatty acids, and sodium compared to Muslim students [220]. Another study conducted among

university students from 22 countries found that university students who frequently attended religious events had a higher prevalence of overweight and obesity [230].

Institute of study can also influence overweight and obesity. A cross-sectional study conducted among university students in Peru found that students studying engineering had a higher risk of developing overweight and obesity compared with students studying humanities, business and medicine [148]. In contrast, a cross-sectional study conducted among university students in Turkey found that university students studying in the Faculty of Medicine had a higher mean BMI compared to university students studying in the Faculty of Social Sciences and Engineering [199].

Year of study is also another socio-demographic factor influencing overweight and obesity among university students. A cross-sectional study conducted among university students in Egypt found that fourth-year university students had a higher prevalence of overweight and obesity than first-year university students [178]. Another study conducted among university students in Jordan also found that fourth-year university students had a higher prevalence of overweight and obesity than first-year university students [128]. A similar study conducted in Botswana found that the risk of overweight and obesity increased as students' years of study increased [240]. On the other hand, a cross-sectional study conducted among university students in the United Arab Emirates found that first-year university students had a higher prevalence of overweight and obesity compared to second-year students [120].

Another sociodemographic factor influencing overweight and obesity is family income. A cross-sectional study conducted among university students in China found that university students who had higher family income had higher odds of being overweight and obese compared with university students who had lower family income [191]. A similar study conducted in China found that university students with greater financial resources were more likely to be overweight and obese compared to university students who had fewer financial resources [273].

Residence is also another factor influencing overweight and obesity among university students. A longitudinal study conducted among first-year university students in Canada found that university students who lived in university residence halls had

higher weight and BMI compared to university students who lived at home with family [247]. Another study conducted among university students in Egypt showed that university students who lived in university dormitories were more likely to be overweight and obese compared to university students who lived at home with family [178].

1.3.2 Nutritional factors affecting overweight and obesity among university students

One of the main environmental factors influencing the development of overweight and obesity is nutrition [166]. Some of the nutritional factors influencing overweight and obesity among university students include nutrition knowledge [271], attitudes toward food [216], food preferences [259], and those listed below.

Nutrition knowledge is one of the risk factors affecting overweight and obesity among university students. A cross-sectional study conducted among students at Central Michigan University in the USA found that nutrition knowledge was negatively correlated with fat and cholesterol intake. In other words, students who consumed more fat or cholesterol daily had lower average nutrition knowledge scores than students who consumed less fat or cholesterol [271].

Attitudes towards nutrition is also another nutritional factor that influences overweight and obesity. A study conducted among university students in Iran found that positive attitudes towards nutrition were associated with a lower BMI and vice versa [214]. Another study conducted among university students in Kuwait also found that negative attitudes towards nutrition increased the risk of overweight and obesity among university students [216].

Another nutritional factor that affects overweight and obesity is food preferences. A telephone survey conducted in Ohio, USA, found that adults who ate only home-cooked meals had a 26% lower risk of obesity than those who ate little or no home-cooked meals [259]. Another population-based study conducted in Tokyo, Japan, found that students who cooked at home less often had a 2.3 times higher risk of developing overweight and obesity than students who cooked at home more often [254]. Similarly, two population-

based studies in China also found that adults who ate out were more likely to be overweight and obese than people who did not eat out [192,263].

Skipping meals is also another dietary factor that contributes to overweight and obesity. A retrospective cohort study conducted among university students in China found that skipping dinner was a significant predictor of overweight and obesity [272]. Another study conducted among university students in Spain found that skipping breakfast was associated with an increased prevalence of overweight and obesity [255]. On the other hand, a study conducted among university students in Brunei found that BMI was not significantly correlated with breakfast consumption [133].

Another dietary factor that influences overweight and obesity is snacking. An online survey conducted among university students in Jeddah, Saudi Arabia found that consumption of snack foods such as cookies, popcorn, and potato chips was strongly associated with an increased risk of overweight and obesity [124]. Similarly, a randomized controlled trial conducted in Seattle, USA, found that snacking was associated with increased BMI [137].

Consumption of fruits and vegetables also affects overweight and obesity. A survey of university students in Brazil found that low consumption of fruits and vegetables increased the risk of being overweight [176]. Another study conducted among university students in Egypt also found that low vegetable consumption was associated with a higher prevalence of overweight and obesity [172]. Similarly, a study conducted among university students in Morocco found that irregular fruit consumption increased the likelihood of overweight and obesity [138].

Another dietary factor that influences overweight and obesity is the consumption of sugary drinks. A survey conducted among university students in China found that higher consumption of all types of sugary drinks increased the likelihood of overweight and obesity [150]. Another study conducted among university students in Saudi Arabia also found that consuming more sugary drinks increased the likelihood of being overweight and obese [125]. A similar study conducted among university students in South Africa found that BMI was significantly associated with the frequency of consumption of foods containing added sugar [218]. A study conducted among university

students in Turkey found that frequent consumption of unhealthy snacks was associated with a higher risk of overweight and obesity [249].

Fast food consumption also influences overweight and obesity among university students. A cross-sectional study conducted among university students in Morocco found that higher fast food consumption (>3 times per week) increased the likelihood of overweight and obesity [138]. Another study conducted among university students in Pakistan found that higher fast food consumption (≥3 times per day) increased the prevalence of overweight and obesity [190]. A similar study conducted among university students in Brunei found that frequent consumption of fast food was associated with a higher prevalence of overweight and obesity [278].

Another nutritional factor that influences overweight and obesity is multivitamin and mineral supplements. A randomized controlled trial conducted in the United Kingdom found that multivitamin and mineral supplementation increased carbohydrate oxidation and increased energy expenditure in men [156]. Another randomized controlled trial conducted in China showed that taking multivitamins and minerals could reduce body weight and obesity [205].

Eating behavior was also another dietary factor influencing overweight and obesity among university students. A survey conducted in Ukraine found that BMI was associated with REB [196]. Another study conducted among university students in Japan found that BMI was positively associated with EkEB, EmEB, and REB [225].

1.3.3 Health status and lifestyle factors affecting overweight and obesity among university students

Research has shown that self-rated health may influence overweight and obesity. A study conducted among university students in the USA found that poor self-rated health was associated with an increased risk of overweight and obesity [226]. Another study conducted among adolescents in Germany found that overweight and obesity were associated with poor self-rated health [202]. On the other hand, a study conducted among

elderly patients with cardiac diseases in Moscow, RF, showed that BMI does not correlate with self-rated health status [46].

Sleep duration may also influence overweight and obesity among university students. A study among university students in the USA and South Korea found that both short sleep duration (<7 h/night) and long sleep duration (>9 h/night) were associated with an increased risk of overweight and obesity [242]. . Other studies conducted among university students in Saudi Arabia also found that short sleep duration was associated with an increased risk of overweight and obesity [122,259]. Additionally, a study conducted in Morocco found that both short and long sleep duration were associated with an increased risk of overweight/obesity in men [138].

Alcohol consumption also affects overweight and obesity. Studies conducted among university students in the USA [158], Thailand [140] and RF [93] showed that increased alcohol consumption was associated with an increased risk of overweight and obesity.

Another lifestyle factor that influences overweight and obesity is smoking. Studies conducted among university students in Brazil [154] and Saudi Arabia [271] found that smoking increases the prevalence of overweight and obesity. On the other hand, a study conducted among university students in Palestine found that cigarette smoking was associated with a decrease in BMI [213].

Family history of overweight and obesity is another factor influencing overweight and obesity among university students. Studies conducted among university students in Brazil [154], Saudi Arabia [211] and Turkey [258] found that university students with a family history of overweight and obesity had an increased risk of developing overweight and obesity.

Psychological distress among students may also influence overweight and obesity. Cross-sectional studies conducted among university students in Brazil [222], USA [121] and China [149] found that higher levels of anxiety and depression were associated with an increased risk of overweight and obesity.

Social support also affects overweight and obesity. A study conducted among Mexican men living in the USA found that higher levels of social support appeared to

reduce the risk of obesity/central obesity [276]. Another study conducted among university students in India found that lack of social support was associated with an increased risk of overweight and obesity [231]. Another study conducted among hospital nurses in Taiwan found that low social support was associated with an increased risk of overweight and obesity [163].

Physical activity also affects overweight and obesity among university students. A systematic review found that physical activity interventions were associated with significant reductions in BMI [233]. Another study conducted among higher education youth in Tajikistan found that increased sedentary behavior was associated with an increased risk of overweight and obesity [87]. A similar study conducted among university students in Yemen found that physical inactivity was associated with an increased risk of overweight and obesity [123]. A study conducted among university students in China also found that low physical activity was associated with overweight and obesity [157]. A study conducted in Moscow, RF, showed that high physical activity increased weight loss by 20% [78]. Another study conducted in Kazan, RF, also found that high levels of physical activity significantly reduced weight gain, especially in women [109].

Sedentary lifestyle also affects overweight and obesity among university students. A study conducted in Peru found that study participants who reported sitting time of more than 8 hours per day were more likely to be obese than those who reported less than 4 hours per day [229]. Another study conducted among adults in the US and Europe found that study participants who sat ≥8 hours per day had a 62% higher risk of obesity compared to study participants who sat less than 4 hours per day [143]. Similarly, a population-based study in China found that employees who spend more time sitting at work are at higher risk of developing overweight or obesity than those who spend less time sitting [277].

The main causes and risk factors for overweight and obesity among university students are presented in Figure 1.

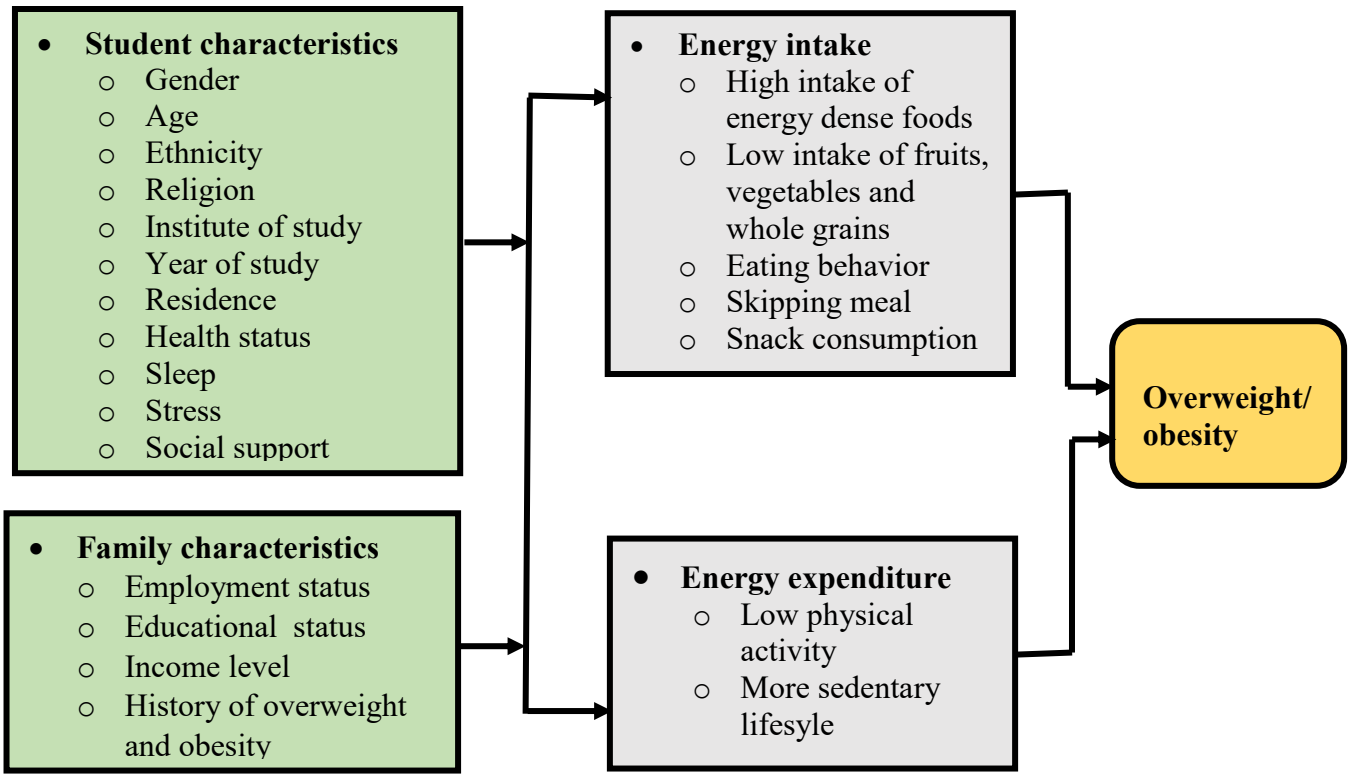


Figure 1 – Causes and risk factors of overweight and obesity among university students

1.4 Consequences of overweight and obesity

The high prevalence of overweight and obesity has an adverse effect on the health of the population, psychosocial functioning, and quality of life for individuals and families, and the economic stability of the nation [3, 17, 27, 43, 54, 56, 67,91, 266].

Type 2 diabetes mellitus (T2DM), cardiovascular diseases (CVD) and cancer are just some of the health consequences of overweight and obesity [11, 20, 70,77]. One of the main consequences of obesity and overweight is CVD. A person who is overweight or obese is more likely to develop coronary heart disease, hypertension, stroke and other CVD [133,204]. Obesity has been considered a major contributing factor to hypertension [31]. Research has shown that overweight and obesity increase the risk of coronary heart disease [21]. Another study also found that higher BMI was closely associated with an increased risk of ischemic stroke [65]. Another consequence of being overweight and obese is type 2 diabetes. Type 2 diabetes has the strongest association with obesity.

Elevated BMI was significantly associated with the incidence of type 2 diabetes. Obesity, as measured by BMI, showed the strongest association with the incidence of type 2 diabetes compared with other comorbidities [22,110]. Cancer is also associated with overweight and obesity. The relationship between obesity and cancer has become a major concern worldwide [1]. Overweight and obesity increase the risk of cancer of the esophagus, pancreas, colon and rectum, breast (postmenopausal), endometrium and kidney [37, 47].

Decreased life expectancy is also associated with overweight and obesity. Research has shown that overweight and obesity are major public health problems that lead to decreased life expectancy, especially in younger age groups. BMI itself, even without taking into account other anthropometric indicators, is a strong predictor of overall mortality. Overall mortality increases when BMI reaches 25 or higher, and an even steeper increase in mortality occurs when BMI exceeds 30 [94, 112].

Overweight and obesity also negatively affect quality of life. There is a social stigma associated with being overweight or obese. Overweight and obese people are the most likely to be ridiculed by teachers, doctors and the public. Social stigma can contribute to increased levels of anxiety, depression and low self-esteem. In some cases, obesity discrimination leads to the development of psychopathology and poor health behavior, which, in a vicious cycle, increases binge eating, bulimia, or other related problems [44, 98].

Overweight and obesity also pose a significant health burden and will have a significant economic impact. Conditions associated with overweight and obesity are among the most costly health care problems, as treatment of these comorbid conditions is associated with increased use and cost of health care services [34, 89].

Literature has shown that there are regional differences in the prevalence and risk factors for overweight and obesity among university students worldwide. This suggests the need to identify country and region-specific medical and social factors affecting overweight and obesity among university students.

CHAPTER 2. MATERIALS AND METHODS OF RESEARCH

2.1 Base and program of the research

The dissertation work was carried out on the basis of the Federal State Autonomous Educational Institution of Higher Education “M.K. Ammosov North-Eastern Federal University” (NEFU) (rector - Doctor of Biological Sciences, Professor Nikolaev A.N.; Director of Medical institute - Candidate of Medical Sciences, Associate Professor Gogolev N.M.; Director of the NEFU Clinic - Candidate of Medical Sciences, Ammosov V.G.) as part of the research work of the Department of Health Organization and Preventive Medicine of the Medical Institute of NEFU in the period from 2020 to 2023.

The study was approved by the Local Ethics Committee of Medical Institute at North Eastern Federal University (Protocol № 33 dated December 15, 2021). All study participants who were included the study provided an online informed consent. Study participants were informed that they can proceed with the survey if they selected “I agree to participate in the study”. Additionally, the confidentiality and anonymity were maintained for the questionnaire.

The object of the study was university students studying at NEFU. The subject of the study is medical and social factors affecting overweight, obesity and eating behavior of student youth (on the example of NEFU).

The research program consisted of 5 stages and is presented in Table 1.

Table 1 – Research program

Research stages	Research methods	Information sources
1. Theoretical analysis of scientific literature on medical and social factors influencing overweight, obesity and eating behavior of university students	Analytical, Informational and analytical, Bibliographic	Domestic and foreign literature
2. Study of NCDs related to nutrition among the population of the RF, the RS (Y) and NEFU students	Retrospective, Analytical, Statistical	Summary statistical reports of the Ministry of Health of the RS (Y) (2020-2022), Statistical reports of NEFU clinic of the North-Eastern Federal University (2020-2022), Form N 131/y "Preventive Medical Examination (Dispensary examination) Record Card"

Continuation of Table 1

3. Study of medical and social factors influencing overweight, obesity and eating behavior of NEFU students	Sociological	Questionnaire for students
4. Analysis and interpretation of survey data on medical and social factors influencing overweight, obesity and eating behavior of NEFU students	Analytical, Statistical	Evaluation matrix Research results
5. Development of preventive measures to reduce overweight and obesity among NEFU students	Analytical	Research Data

At the first stage, a program was developed, setting and justifying the goals and objectives of the study. An analysis of literary sources on current problems of overweight and obesity among university students (prevalence, risk factors, and consequences) was carried out.

At the second stage, we analyzed the dynamics of statistical indicators characterizing the situation with primary incidence of neoplasms, diseases of the endocrine system, nutritional and metabolic disorders, diseases of the circulatory system, diseases of the digestive system and diseases of the genitourinary system of the population of the Russian Federation for the period 2020-2022, according to according to official statistics.

We also analyzed the dynamics of statistical indicators characterizing the incidence of neoplasms, diseases of the endocrine system, nutritional and metabolic disorders, diseases of the circulatory system, diseases of the digestive organs and diseases of the genitourinary system of the population of RS(Y) for the period 2020-2022, according to the data of Ministry of Health of RS(Y).

Taking into account the principle of organizing medical support for NEFU students - on the basis of the NEFU Clinic (director - Candidate of Medical Sciences V.G. Ammosov), annual reports on the work of this medical institution were also sources of statistical data regarding certain diseases (2020-2022). Data from Federal Tax Service No. 12 “Information on the number of diseases registered in patients living in the service area of a medical organization” was copied and analyzed. To assess the health status of

students of NEFU, the study was conducted by a continuous method based on the data of preventive medical examination records (record form 131/y) for 2020-2022.

At the third stage, as part of the study of medical and social factors affecting overweight, obesity and eating behavior of students of NEFU, we developed and adapted an original questionnaire.

The questionnaire included 125 questions, divided into 10 blocks [39,111, 138, 152, 155, 159, 161, 197, 198, 239, 252, 261, 264]:

Block 1. Socio-demographic and economic characteristics

Block 2. Anthropometric characteristics (body weight and height)

Block 3. Nutrition knowledge

Block 4. Attitudes towards nutrition

Block 5. Dietary intake

Block 6. Eating behavior

Block 7. Health status and lifestyle

Block 8. Psychological distress

Block 9. Social support

Block 10. Physical activity and sedentary lifestyle

The questionnaire was adapted and translated from English into Russian using a multi-stage methodology, double-blind review. The following methodology was used to adapt the Russian version:

1. Translation of the questionnaire from the English version by two translators who are not related to each other.
2. Comparison of translation results, identifying differences.
3. A sociologist's assessment of a questionnaire for NEFU students.
4. Evaluation by translators of the translation results, determination of a more accurate answer option proposed by the translators (criteria: 1 - agree, 2 - disagree)/
5. Testing of the Questionnaire on a focus group of six NEFU students.
6. The psychologist's assessment of the difficulties of students' understanding and interpretation of Questionnaire questions. Evaluation of testing results and adjustment of questions.

7. Translation of the developed Russian version of the Questionnaire into English.

8. Analysis of the results of translating the Russian version into English.

9. Translators' assessment of translation results (criteria: 1 – agree, 2 – disagree).

10. Approval of the Russian-language version of the Questionnaire for conducting a survey of NEFU students.

The latest version of the adapted Russian-language version of the questionnaire was 100% agreed upon by the translators.

At the fourth stage, we analyzed and interpreted the survey data on medical and social factors affecting overweight, obesity and eating behavior of NEFU students. The analysis of the research results was carried out using SPSS version 23.

The fifth stage included scientific substantiation and development of preventive measures to reduce overweight and obesity among student youth (based on the data of NEFU).

2.2 Sample size and sampling methods

The sample size required for the study was calculated using the formula of Daniel W.W., 1999 [147]:

$$n = \frac{Z^2\, p\,(1-p)}{d^2} =$$

Where:

n — minimum sample size

Z — confidence level (1.96 for 95% confidence level)

p — prevalence of overweight and obesity

d — margin of error

The prevalence (p) of overweight and obesity for sample size calculation was obtained from 3 previous studies, and the study that provided the largest sample size was selected (Table 2).

Table 2 – Methods for calculating sample size for the study

Previous study	Reference	Prevalence (p) of overweight and obesity (%)	Confidence level (Z)	Margin of error (d)	Calculated Sample size (n)
Study 1	[7]	12.66	95%	5%	170
Study 2	[93]	16.2*	95%	5%	209
Study 3	[81]	12.5	95%	5%	168

Note: *This was the prevalence of overweight and obesity used to determine the sample size for this study.

Comparing sample sizes calculated using previous studies, the prevalence of overweight and obesity that gave the maximum calculated sample size (209 university students) was 16.2% [93]. By adding 10% for non-response, the sample size increased to 230. Since this study used a multistage sampling method, a design effect of 1.5 was used, and the final sample size was 345 NEFU students.

NEFU consists of 12 institutes and 5 faculties. To select study participants, a multistage sampling method was used. First, six institutes in NEFU were selected by simple random sampling (SRS) technique. The randomly selected institutes were the Medical Institute, Institute of Physical Culture and Sports, Pedagogical Institute, Institute of mathematics and Informatics, Institute of Natural Sciences and Institute of Physics and Technology. Then, with the help of curators, invitations were sent to all undergraduate students of the selected institutes to complete the online survey. Finally, a total of 345 study participants from the chosen institutes who agreed to participate in the study were selected by SRS (Figure 2).

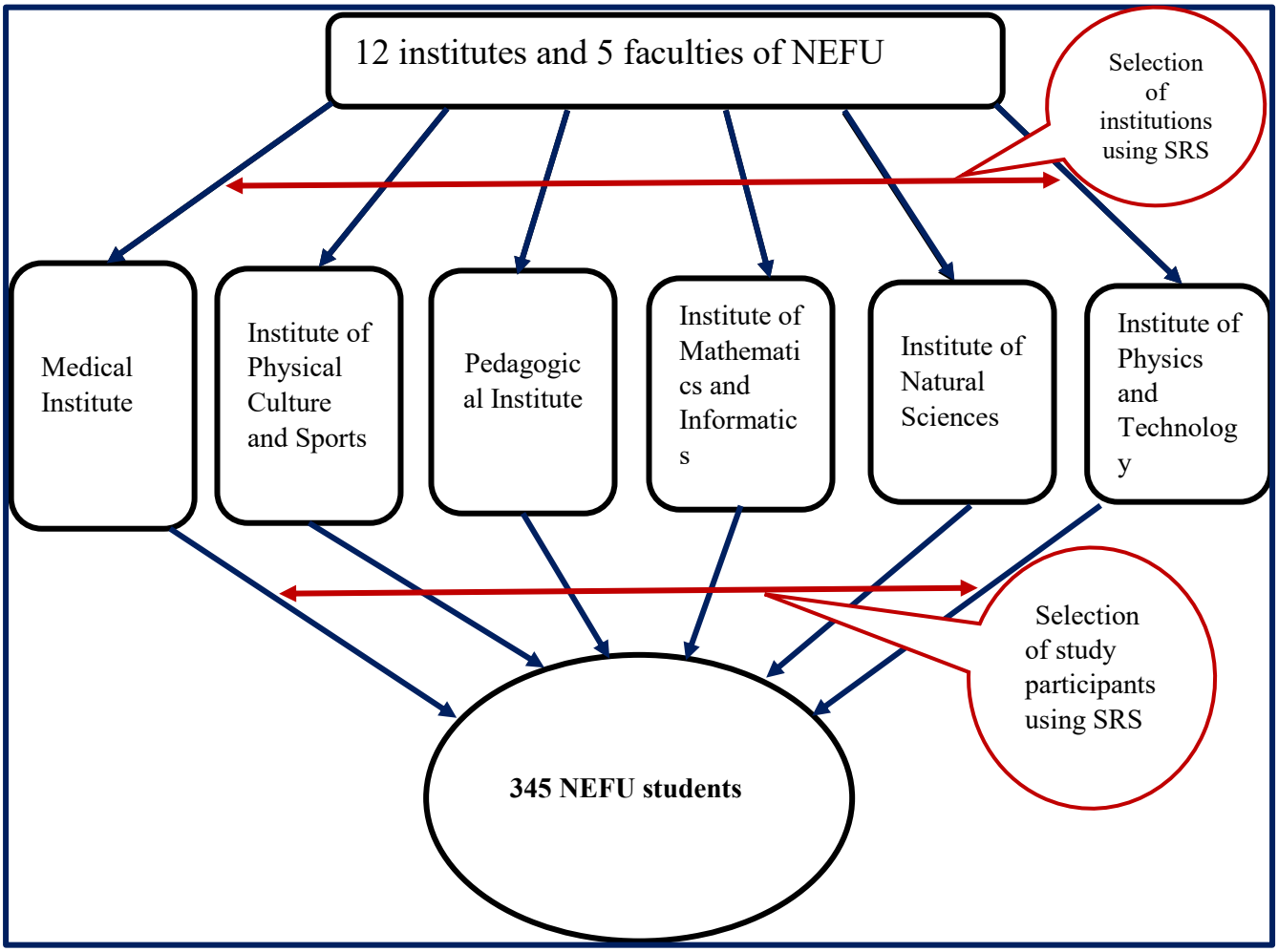


Figure 2 – Scheme of the procedure for selecting respondents

2.3 Inclusion and exclusion criteria

All undergraduate students from the selected institutions who agreed to participate in the study were included in the study. Undergraduate students under 18 years of age, undergraduate students over 25 years of age, pregnant undergraduate students (for girls), undergraduate students who were seriously ill, undergraduate students who studied outside the selected institutes, undergraduate students who refused to participate in the study and master's students, residents and postgraduate students were excluded from the study.

2.4 Study variables and tools for data collection

There were two types of variables in this study: dependent variable and independent variables. The main dependent variables in this study were overweight and obesity. Independent variables can be divided into three categories. The first category of independent variables were socio-demographic and economic variables such as gender, age, country of origin, ethnicity, religion, marital status, institute of study, year of study, mother's educational status, father's educational status, mother's employment status, father's employment status, self-rated family income, opportunity to earn extra money, monthly expenses for food, residence and satisfaction with NEFU services. The second categories of independent variables were nutrition variables, such as knowledge about nutrition, attitudes towards nutrition, nutrition practices, dietary pattern, eating behavior (ExEB, EmEB and REB), etc. The third category of independent variables were health and lifestyle variables such as self-rated health, seeking medical help, sleep duration, smoking status, family history of overweight and obesity, psychological distress, social support, physical activity and sedentary life style.

The survey of students carried out in the framework of the study was conducted by sociological method using the developed and adapted questionnaire (Appendix B). The questionnaire was created using Yandex forms, and then the link was sent to the study participants.

2.4.1 Assessment of socio-demographic and economic variables

To assess socio-demographic variables, each participant was asked to fill out a questionnaire indicating gender, age, country of origin, ethnic origin, religion, marital status, institute of study, year of study, educational status of the mother, educational status of the father, employment status of the mother, employment status father, self-rated income level of the family, opportunity to earn extra money, monthly expenditure on food, residence and satisfaction with NEFU services.

2.4.2 Assessment of BMI

Self-reported weight and height were used to determine the BMI of study participants. Weight in kilograms divided by height in meters squared gives a person's BMI (kg/m^2) [159]. Finally, study participants were divided into four BMI categories: BMI <18.5 kg/m^2 for underweight; BMI 18.5–24.9 kg/m^2 for normal weight; BMI 25.0–29.9 kg/m^2 for overweight and BMI >30 kg/m^2) for obesity [23,168,268]. BMI < 25 kg/m^2 was coded as 0 (non-overweight and non-obese), and BMI ≥ 25 kg /m^2 was coded as 1 (overweight and obese) for the purposes of logistic regression analysis.

2.4.3 Assessment of nutrition knowledge

Nutrition knowledge was assessed using the General Nutrition Knowledge Questionnaire developed by University College London [197]. A total of 17 questions were asked about nutrition, weight management and diseases. Correct answers to nutrition knowledge questions had a value of 1, and incorrect answers had a value of 0. The total knowledge score ranged from 0 to 17. Good nutrition knowledge was defined as having an average knowledge score ≥ 7.5 points, and poor nutrition knowledge as having defined as having an average knowledge score <7.5 points.

2.4.4 Assessment of attitudes towards nutrition

Attitudes towards nutrition were assessed using the Food Attitudes and Behaviors (FAB) survey developed by the USA National Cancer Institute [161]. A total of 5 questions were asked about attitudes towards nutrition. Responses were evaluated using a 5-point Likert scale ((1= strongly disagree; 2= Disagree; 3= neither agree nor disagree; 4= Agree; 5 =strongly agree).The total number of points for the attitudes towards nutrition ranged from 5 to 25. Positive attitude towards nutrition is defined as having median attitudes towards nutrition score ≥ 16 points, and negative attitude towards nutrition is defined as having a median attitudes towards nutrition score < 16 points.

2.4.5 Assessing nutrition practices (Dietary intake)

Dietary intake was assessed using a short qualitative food frequency questionnaire, the Food Frequency Questionnaire (FFQ). The food frequency questionnaire for this study was adapted from various literature sources [155,239,264]. The FFQ consists of a predefined list of food and beverage items with response categories indicating the usual frequency of consumption during the previous week. A total of 15 questions were asked about food frequency. Healthy food groups such as grains, fruits and vegetables were covered in questions 1 to 9, and unhealthy food groups such as sweets, sugary drinks and condiments were covered in questions 10 to 15 [256]. Responses to these food frequency questions were assessed using (1 = never, 2 = once a week, 3 = 2–3 times a week, 4 = 4–6 times a week, 5 = once a day, 6 = more than once a day). The scoring for questions 10 to 15 was reverse coded. The minimum score for nutrition practice was 15 and the maximum score was 90. Good nutrition practice was defined as an average practice score ≥ 48 points, and poor practice was defined as a score < 48 points. To analyze dietary patterns, additional questions were also asked about food preferences, meal skipping, snack consumption, and use of dietary supplements.

2.4.6 Assessment of eating behavior

To identify types of eating disorders, the Dutch Eating Behavior Questionnaire (DEBQ) [261] was used, which is aimed at identifying REB, EmEB, ExEB. The instrument (questionnaire) consists of 33 questions, each question has 5 response options (5-point Likert scale): 1 - never, 2 - rarely, 3 - sometimes, 4 - often and 5 - very often, except for 31st question which have a reverse values. Scoring was done by summing the scores for each item on the scale and dividing the resulting sum by the number of items on the given scale. The first 10 questions represented the REB scale, which is characterized by self-restraint (control) in nutrition to achieve or maintain the desired body weight. The next 13 questions represented the EmEB scale, in which the desire to eat occurs in response to negative emotional states. The next 10 questions represented the

ExEB scale, in which the desire to eat is stimulated by the appearance of food, its smell, texture, or the sight of other people eating food. The mean score for REB is 2.4 points, for EmEB is 1.8 points, and for ExEB is 2.7 points, with deviations for these three types are considered a point above the mean [45, 68, 103, 111].

2.4.7 Assessment of health status and lifestyle

To assess lifestyle and health status, each participant was asked questions about self-rated health, health care utilization, sleep duration, smoking status, and parental history of overweight and obesity. Based on previous studies, study participants were grouped into three sleep categories: short sleep duration (less than 7 hours), healthy sleep duration (7–8 hours), and long sleep duration (more than 9 hours) [138, 184].

2.4.8 Assessment of psychological distress

Psychological distress was assessed using the Hopkins Symptom Checklist-10 (HSCL-10). The HSCL-10 consists of 10 items on a 4-point scale: “Not at all,” “A little,” “Quite a bit” and “Very much.” Four of the ten questions relate to anxiety and six questions to depression. The average HSCL-10 score was calculated by dividing the total score by ten. A mean score of 1.85 or higher indicates symptoms of anxiety and depression [252].

2.4.9 Assessment of social support

Social support is interactions with family members, peers, friends, and professionals who share information and provide practical or emotional support [251]. Social support was assessed using the Oslo Social Support Scale-3 (OSS-3) using three questions [198]. For the OSS-3, response categories were assigned separate scores for each of the three questions. The sum of the scores for each item was used to determine the final score. The total score ranges from 3 to 14, with high scores indicating high levels

of social support and low scores indicating low levels of social support. Three broad categories can be identified from the OSS-3 total score: 3–8 indicating poor social support, 9–11 indicating moderate social support and 12–14 indicates strong social support [198].

2.4.10 Assessment of physical activity and sedentary life style

Physical activity and sedentary lifestyle were assessed using a short version of the International Physical Activity Questionnaire (IPAQ) [39, 152]. Based on the IPAQ assessment protocol, physical activity levels were classified as low, moderate, and high. A "HIGH" physical activity rating on the IPAQ means you perform vigorous activity for at least 3 days, achieving a minimum total physical activity of at least 1,500 minutes of Metabolic Equivalent of Task (MET) per week OR 7 or more days of any combination walking, moderate-intensity or vigorous exercise providing a minimum total physical activity of at least 3000 MET-minutes per week. A “MODERATE” physical activity level rating on the IPAQ means you do 3 or more days of vigorous physical activity and/or walking OR 5 or more days of moderate intensity activity and/or walking at least 30 minutes per day OR 5 or more days any combination of walking, moderate-intensity activity, or vigorous-vigorous exercise achieves a minimum total physical activity of at least 600 MET minutes per week. An IPAQ rating of "LOW" physical activity means you do not meet any of the "MODERATE" or “HIGH” level of physical activity. In response to a single question about how much time they spent sitting each day for the previous seven days, participants self-reported the amount of time they spent sitting [39,152]. As a result, sitting time was divided into three categories: <3 hours per day, 4–6 hours per day, and >6 hours per day [187,189].

2.5 Data processing, analysis and quality control

First, the data collected through the online survey were checked for completeness. Second, the data were exported to Statistical Package for Social Sciences (SPSS) version

23 for further analysis. Third, the data were coded and exploratory data analysis was conducted. Descriptive statistics such as frequencies, percentages, and means were then determined. Chi-square test, correlation test, and independent sample t-test were also conducted.

Both bivariate and multivariate logistic regression analyzes were performed to identify variables associated with overweight and obesity. In the current study, variables that were associated with overweight and obesity at a significance level of $p < 0.25$ in bivariate logistic analysis were selected for potential inclusion in multivariable logistic regression [144,186]. Before performing multivariate logistic analysis, multicollinearity (Variance Inflation Factor (VIF<3)) and the Hosmer-Lemeshow test (>0.05) were checked [185,195].

In the multivariable logistic regression, adjusted odds ratio (AOR), along with 95% confidence interval (95% CI) were estimated to identify factors associated with overweight and obesity. The level of statistical significance was set at p-value <0.05. To identify factors associated with REB, EmEB and ExEB, both bivariate and multivariate logistic regression analyzes were also performed.

The mathematical model of logistic regression was calculated according to the formula of Fox J., 2016 [167]:

$$p = \frac{1}{1+e^{-(b_o+b_1X_1+\ldots+b_nX_n)}}$$

Where,

p – probability

e – base of natural logarithm (e= 2.72)

b_0 – model constant

b_1 - coefficient for predictor variable X_1

X_1 to X_n – predictor variables

n- the total number of the predictors included in the equation

Receiver operating characteristic (ROC) analysis was used to evaluate the sensitivity and specificity of logistic regression models. To quantitatively interpret the results of ROC curves, the area under the curve (AUC) value was assessed, which ranges

from 0 to 1. An AUC value from 0.5 to 0.6 indicates poor performance, values from 0.6 to 0. 7 indicate satisfactory; values between 0.7 and 0.8 indicate good quality; values between 0.8 and 0.9 indicate very good quality, and values between 0.9 and 1 indicate excellent model quality [107].

The questionnaire was written in English, translated into Russian, and then translated back into English to ensure consistency in the data collection instrument. Pretesting was conducted on 10% of the sample to maintain data quality.

The reliability of the questionnaire was determined using Cronbach's alpha coefficient (α) (Table 3).

Table 3- Reliability tests for the questionnaire

Variable	Number of questions	Cronbach's alpha (α)
Nutrition knowledge	17	0.743
Attitude towards nutrition	5	0.723
Practice towards nutrition	15	0.844
REB	10	0.931
EmEB	13	0.953
ExEB	10	0.842
Psychological distress	10	0.915
Social support	3	0.717
Physical activity	10	0.952

The reliability of the questionnaire was also determined using Cronbach's alpha coefficient (α) and it showed good internal reliability [215].

CHAPTER 3. INCIDENCE OF NON-COMMUNICABLE DISEASES RELATED TO NUTRITION AMONG THE POPULATION OF THE RUSSIAN FEDERATION, THE REPUBLIC OF SAKHA (YAKUTIA) AND NEFU STUDENTS (FOR 2020-2022)

NCDs, also known as chronic diseases, tend to be long-lasting and result from a combination of physiological, genetic, behavioral and environmental factors. Chronic NCDs such as obesity, CVD, hypertension, stroke, T2DM and some cancers are increasingly common causes of disability and early mortality in developing and developed countries [10, 11, 24].

NCDs account for 41 million deaths annually, or 74% of all deaths globally. Each year, 17 million people die from a NCD before age 70; 86% of these premature deaths occur in low- and middle-income countries. The majority of NCD deaths, or 17.9 million annually, are caused by CVD, with cancers coming in second with 9.3 million, chronic respiratory diseases with 4.1 million, and diabetes with 2.0 million deaths [24, 171].

In the RF, NCDs are also a leading cause of death and disability and account for 87% of all deaths in the country. It is estimated that the average person in RF has a 25% risk of dying prematurely (before age 70) from one of the four major NCDs – CVD, cancer, diabetes and chronic respiratory diseases. In 2016, 1,635,000 people in RF died from NCDs while still in their prime working age [269].

Changes in diet and lifestyle are major causes of NCDs. The four main metabolic changes that increase the risk of NCDs are overweight/obesity, hypertension, hyperlipidemia (high concentration of fats in the blood) and hyperglycemia (high blood sugar). High blood pressure is the leading metabolic risk factor for mortality worldwide (associated with 19% of deaths worldwide), followed by hyperglycemia and overweight/obesity [170, 171].

3.1 Primary incidence of non-communicable diseases related to nutrition among the population of the Russian Federation according to Rosstat (for 2020-2022)

According to the data of Rosstat (for 2020-2022), the primary incidence of neoplasms, diseases of the endocrine system, nutritional and metabolic disorders, diseases of the circulatory system, diseases of the digestive system and diseases of the genitourinary system among the entire population of the RF (per 1000 population) had an increasing trend. For example, the primary incidence of neoplasms in the population of the RF (per 1000 population) in 2020 and 2022 were 9.8 and 10.8, respectively (Figure 3).

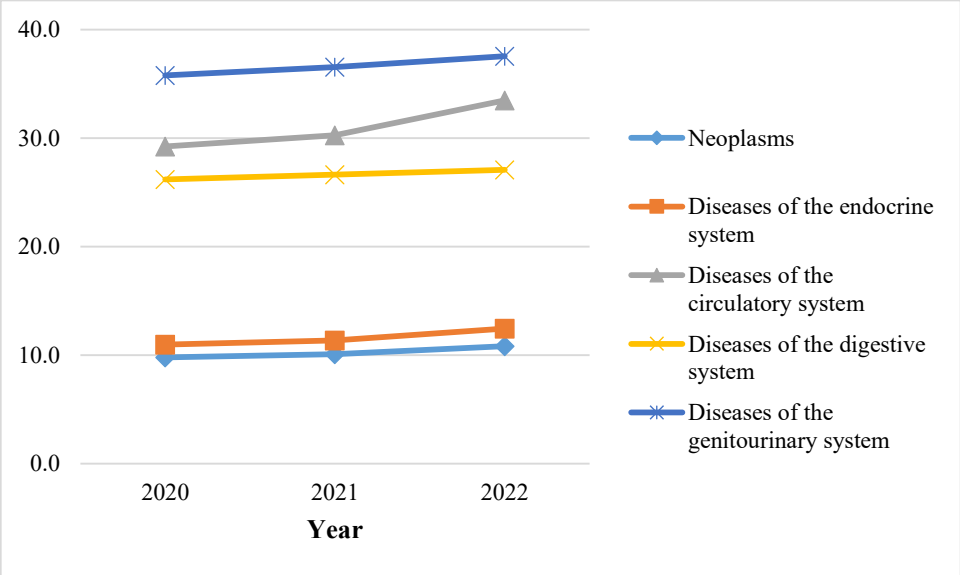


Figure 3 – Primary incidence of neoplasms, diseases of the endocrine system, nutritional and metabolic disorders, diseases of the circulatory system, digestive system and genitourinary system among the population of the RF (per 1000 population) according to Rosstat (2020-2022)

According to the data of Rosstat (for 2020-2022), the primary incidence of diabetes mellitus, high blood pressure and malignant neoplasms among the population of the RF (per 1000 population), had an increasing trend. For example, the primary incidence of high blood pressure among the population of the RF (per 1000 population) in 2020 and 2022 were 9.3 and 11.7, respectively (Figure 4).

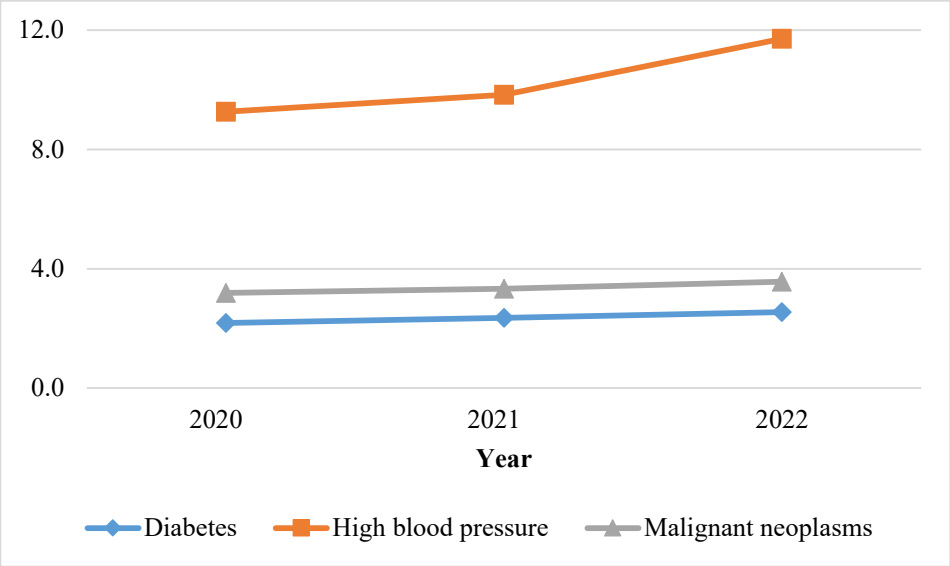


Figure 4 – Primary incidence of diabetes mellitus, high blood pressure and malignant neoplasms among the Russian population (per 1000 population) (according to Rosstat for 2020-2022)

3.2 Primary incidence of non-communicable diseases related to nutrition among the population of the Republic of Sakha (Yakutia) (for 2020-2022)

According to the data of Ministry of Health of the RS (Y) (for 2020-2022), the primary incidence of neoplasms, diseases of the endocrine system, nutritional and metabolic disorders, diseases of the circulatory system, diseases of the digestive and genitourinary systems among the entire population of the R(Y) (per 1000 population) had an increasing trend. For example, the primary incidence of digestive diseases among the population of the RS (Y) (per 1000 population) in 2020 and 2022 were 43.4 and 50.5, respectively (Figure 5).

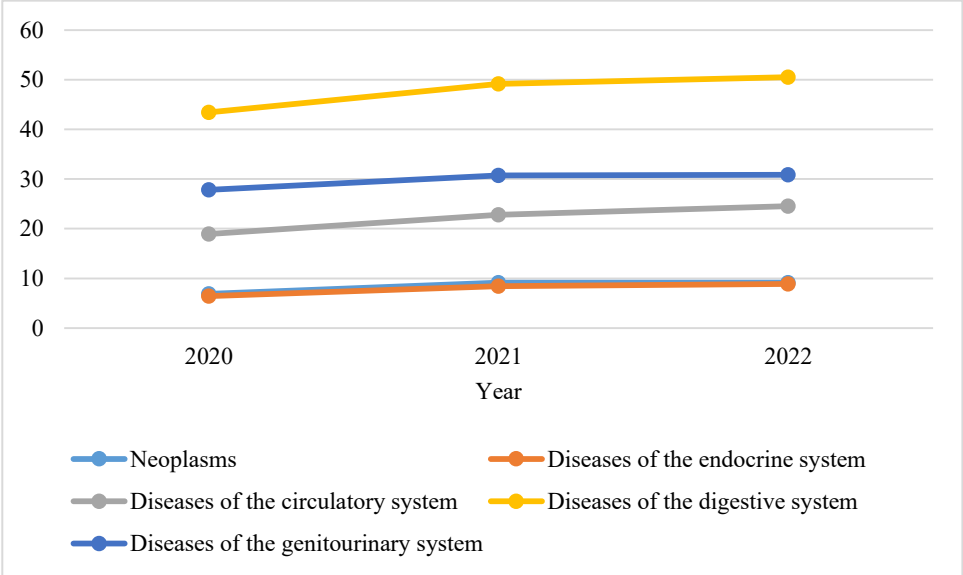


Figure 5 – Primary incidence of neoplasms, diseases of the endocrine system, nutritional and metabolic disorders, diseases of the circulatory system, digestive system and genitourinary system among the entire population of the RS (Y) (per 1000 population) (according to data for 2020-2022)

According to the Ministry of the RS (Y) (for 2020-2022), primary incidence of high blood pressure and coronary heart disease among the entire population of the RS (Y) (per 1000 population) had an increasing trend, with the highest values recorded in 2022. For example, the primary incidence of high blood pressure among the population of the RS (Y) (per 1000 population) in 2020 and 2022 were 6.2 and 9.4, respectively (Figure 6).

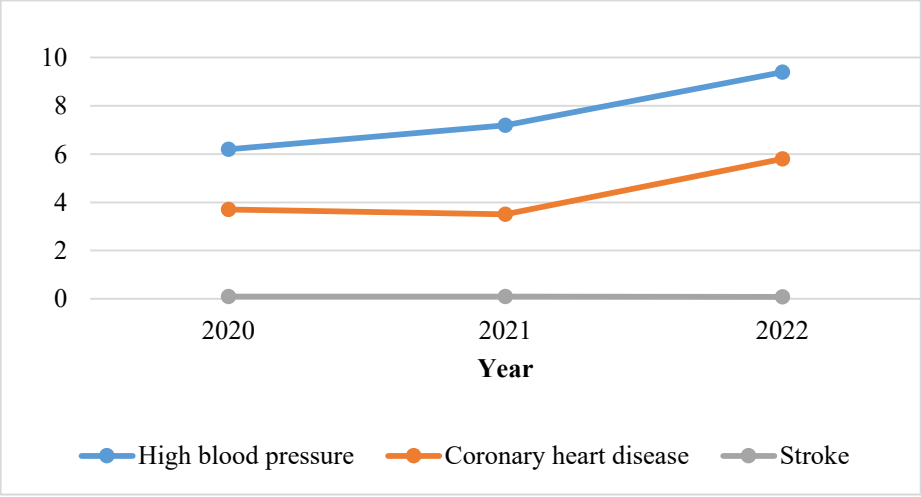


Figure 6 – Primary incidence of high blood pressure, coronary heart disease and stroke among the entire population of the RS (Y) (per 1000 population) (according to data for 2020-2022)

3.3 Frequency (pathological incidence) of non-communicable diseases related to nutrition among NEFU students according to the NEFU clinic (2020-2022)

According to the data of medical examinations of students in the clinic of NEFU (Director - Candidate of Medical Sciences, Ammosov V.G.) for 2020-2022, the frequency (pathological incidence) of neoplasms, diseases of the endocrine system, nutritional and metabolic disorders and diseases of the circulatory system among students of NEFU (per 1000 examined students), had a decreasing trend. On the other hand, the frequency of diseases of the digestive organs and genitourinary system among students of NEFU (per 1000 examined students), had an increasing trend (Figure 7).

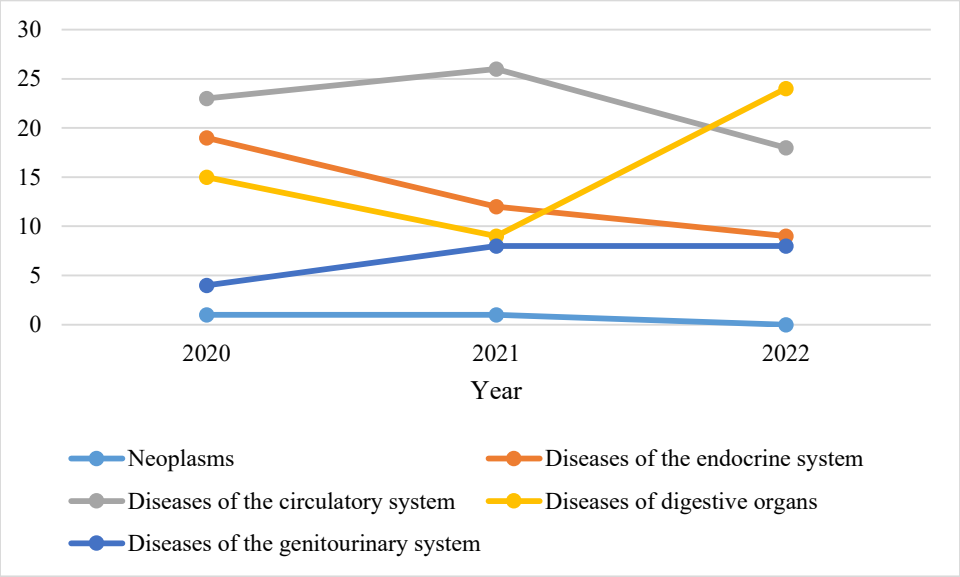


Figure 7 – Pathological incidence of neoplasms, diseases of the endocrine system, nutritional and metabolic disorders, diseases of the circulatory system, digestive and genitourinary systems among NEFU students (per 1000 examined students) according to the NEFU Clinic (2020-2022)

According to medical examinations of students at the NEFU clinic, the frequency of diabetes mellitus, obesity and high blood pressure among NEFU students (per 1000 examined students), had a decreasing trend. For example, the frequency of high blood pressure among NEFU students (per 1000 students examined) in 2020 and 2022 were 18 and 9, respectively (Figure 8).

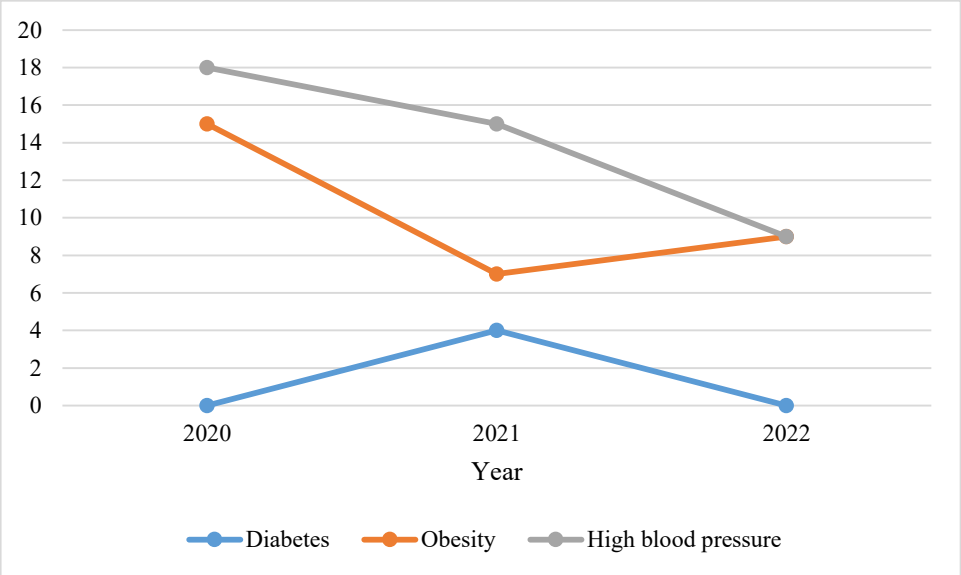


Figure 8 – Pathological incidence of diabetes mellitus, obesity and high blood pressure among NEFU students (per 1000 examined students) according to the NEFU Clinic (2020-2022)

Based on the data of medical examination, the frequency of diseases identified during a medical examination or pathological obesity among NEFU students (per 1000 examined students) is presented in Table 4.

Table 4 – Frequency of obesity among NEFU students (pathological incidence per 1000 examined students) according to medical examination in 2023

Institute of study	Obesity			
	Total	Class- 1	Class- II	Class III
Geological Exploration Faculty	0.8	0.6	0.2	0
Institute of Foreign Philology and Regional Studies	0.9	0.7	0.2	0
Financial and Economic Institute	0.7	0.6	0.1	0
College of Law	0.7	0.4	0.3	0
Faculty of Law	0.9	0.6	0.3	0
Automotive Faculty	0.4	0.3	0	0.1
Mining Institute	0	0	0	0
College of Infrastructure Technologies	0	0	0	0
Medical institute	0.7	0.1	0.6	0
Institute of Physics and Technology	0.1	0	0.1	0
Engineering and Technical Institute	0.3	0.1	0.2	0
Pedagogical Institute	0.3	0.3	0	0
Institute of Languages and Cultures of the Peoples of the North-East of the RF	0.1	0	0.1	0
Faculty of history	0.2	0.1	0	0.1
Faculty of philology	0.1	0	0.1	0
Institute of Physical Culture and Sports	0.2	0.2	0	0
Institute of Psychology	0.2	0.2	0	0
Institute of Natural Sciences	0.3	0.1	0.2	0
Institute of Mathematics and Informatics	0.3	0.2	0.1	0
Total	7.2	4.5	2.5	0.2

As shown in Table 4, the frequency of obesity among law and geological exploration students (per 1000 examined students) in 2023 was 0.9 and 0.8, respectively. The overall frequency of obesity detected during medical examination or pathological involvement among NEFU students (per 1000 examined students) in 2023 was 7.2.

Retrospective data from Rosstat and the Ministry of Health of the Republic of Sakha (Yakutia) (for 2020-2022) showed that the primary incidence of non-communicable diseases related to nutrition among the entire population of the Russian Federation and the Republic of Sakha (Yakutia) (per 1000 population), had an increasing trend. On the other hand, the frequency (pathological incidence) of these diseases among NEFU students (per 1000 examined students), had a fluctuating trend.

CHAPTER 4. MEDICAL AND SOCIAL FACTORS AFFECTING OVERWEIGHT, OBESITY AND EATING BEHAVIOR AMONG NEFU STUDENTS

4.1 Medical and social factors affecting overweight and obesity among NEFU students

4.1.1 Socio-demographic and economic characteristics of NEFU students

In this study, a total of 384 study participants were included in the final analysis (Table 5).

Table 5 – Socio-demographic and economic characteristics of NEFU students

Variable		Frequency (%)
Gender	Male	142 (37.0)
	Female	242 (63.0)
Age (in years)	Mean ± SD	20.93±2.10
Country of origin	RF	342 (89.0)
	Egypt	21(5.5)
	Uzbekistan	7 (1.8)
	Tajikistan	6 (1.6)
	Others	8 (2.1)
Ethnic Background	Sakha (Yakut)	301 (78.4)
	Russian	15 (3.9)
	Egyptian	16 (4.2)
	Evenk	11 (2.9)
	Uzbek	7 (1.8)
	Others	34 (8.8)
Religion	Atheist	137 (35.7)
	Pagan	97 (25.3)
	Orthodox Christian	62(16.1)
	Catholic	28 (7.3)
	Muslim	39 (10.1)
	Others	21 (5.5)
Marital status	Unmarried	358 (93.2)
	Married	26(6.8)
Institute	Medical Institute	211 (54,9)
	Institute of Physical Culture and Sports	70 (18.2)
	Pedagogical Institute	57 (14.8)
	Institute of Mathematics and Informatics	24 (6.3)
	Institute of Natural Sciences	14 (3.6)
	Institute of Physics and Technology	8 (2.1)

Continuation of Table 5

Year of study	First year	151 (39.3)
	Second year	56 (14.6)
	Third year	65 (16.9)
	Fourth year and above	112 (29.2)
Mother's level of education	No education	18 (4.7)
	Primary education	4 (1.0)
	Secondary education	66 (17.2)
	Secondary vocational education	107 (27.9)
	Higher education	169 (44.0)
	Don't know / refused to answer	20 (5.2)
Father's educational level	No education	25 (6.5)
	Primary education	5 (1.3)
	Secondary education	74 (19.3)
	Secondary vocational education	112 (29.2)
	Higher education	119 (31.0)
	Don't know / refused to answer	49 (12.8)
Mother's employment status	Employed	239 (62.2)
	Unemployed	33 (8.6)
	Pensioner	74 (19.3)
	Don't know / refused to answer	38 (9.9)
Father's employment status	Employed	212 (55.2)
	Unemployed	25 (6.5)
	Pensioner	54 (14.1)
	Don't know / refused to answer	93 (24.2)
Family income level	Below average	81 (21.1)
	Average	257 (66.9)
	Above average	28 (7.3)
	Don't know / refused to answer	18 (4.7)
Part-time job	Yes	218 (56.8)
	No	166 (43.2)
Monthly expenditures on food (in Rubles)	Mean ± SD	11754.04±5516.54
Living in NEFU dormitory	Yes	249 (64.8)
	No	135 (35.2)
Satisfied with NEFU services	Yes	330 (85.9)
	No	54 (14.1)

Note: SD- standard deviation, NEFU-North Eastern Federal University

As shown in Table 5, the majority of students (63%) were females with a mean age of 20.93±2.10 years. Regarding the country of origin, 89% of NEFU students were from the Russian Federation. By ethnic origin, 78.4% of students were Yakut. The majority of the students were atheists and pagans, accounting for 35.7% and 25.3% of the students, respectively. About 93.2% of students were unmarried. Regarding accommodation, 56.8% of students lived in the university dormitory. Regarding institute of study, 54.9% of respondents were medical students. About 39.3% were in their first year of study.

4.1.2 Nutrition characteristics among NEFU students

4.1.2.1 Nutrition knowledge among NEFU students

About 71.1% of study participants correctly answered that cutting out fat completely does not help maintain a healthy weight. Likewise, about 69.0% of study participants correctly answered that an apple body shape increases the risk of CVD. On the other hand, only 19.3% of study participants correctly answered that obesity is a weight status with a BMI of 31 kg/m^2. Similarly, only 15.6% of study participants correctly answered that eating less red meat helps prevent cancer. Overall, half of the study participants (50%) had good nutrition knowledge (Table 6).

Table 6 – Nutrition knowledge among NEFU students

Question		Correct Answer Frequency (%)
Which of the diseases is related to a low intake of fiber?		193 (50.3)
Which of these diseases is related to how much sugar people eat?		225 (58.6)
Which of the diseases is related to how much salt (or sodium) people eat?		95 (24.7)
Which of these options do experts recommend to reduce the chances of getting cancer?		60 (15.6)
Which of these options do experts recommend to prevent heart CVD?		205 (53.4)
Какие из этWhich of these options do experts recommend to prevent diabetes?		188 (49.0)
Which one of these foods is more likely to raise people's blood cholesterol?		156 (40.6)
Which one of these foods is classified as having a high Glycemic Index?		140 (36.5)
To maintain a healthy weight people should cut fat out completely.		273 (71.1)
To maintain a healthy weight people should eat a high protein diet.		136 (35.4)
Eating bread always causes weight gain.		186 (48.4)
Dietary fiber can decrease the chances of gaining weight.		112 (29.2)
Reading food labels can help people to maintain a healthy weight.		239 (62.2)
Taking nutritional supplements can help people to maintain a healthy weight.		128 (33.3)
If someone has a BMI of 23kg/m2, what would their weight status be?		115 (29.9)
If someone has a BMI of 31kg/m2, what would their weight status be?		74 (19.3)
Which of these body shapes increases the CVD?		265 (69.0)
Median $\pm$ Interquartile range (IQR)		7,5 $\pm$5
Nutrition knowledge level	Good knowledge	192 (50.0)
	Poor knowledge	192(50.0)

4.1.2.2 Attitudes towards nutrition among NEFU students

About 32.8% of students strongly agreed that their family or friends encourage them to eat fruits and vegetables. Only 12.2% of students strongly agreed that they eat enough fruits and vegetables to control their weight and stay healthy. Overall, about 53.6% of the study participants had positive attitudes towards nutrition (Table 7).

Table 7 – Attitudes towards nutrition of NEFU students

Question	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
I am confident to eat a healthy snack, like a fruit/ vegetable, when hungry.	26 (6.8)	38 (9.9)	138(35.9)	70 (18.2)	112 (29.2)
I am confident to eat fruits/ vegetables instead of cake, cookies, candy, ice cream, or other sweets for dessert.	42 (10.9)	86(22.4)	132(34.4)	43 (11.2)	81 (21.1)
My family/friends encourage me to eat fruits and vegetables.	29 (7.6)	21 (5. 5)	109(28.4)	99 (25.8)	126 (32.8)
I eat enough fruits and vegetables to control my weight.	46 (12.0)	97(25.3)	144(37.5)	50(13.0)	47 (12.2)
I eat enough fruits and vegetables to keep me healthy.	40 (10.4)	97(25.3)	130(33.9)	70(18.2)	47 (12.2)
Median ±IQR				16 ±5	
Attitudes towards nutrition level	Positive attitude			206 (53.6)	
	Negative attitude			178 (46.4)	

4.1.2.3 Nutrition practices among NEFU students

Among NEFU students, food intake was assessed using a qualitative food frequency questionnaire over the past 7 days. About 14.6%, 15.1% and 20.8% of NEFU students consumed cereals, meat, oils and fats once a day, respectively. Only 1.3% and 0.8% of NEFU students consume fish and legumes, nuts and seeds once a day, respectively. In general, about 57.8% of NEFU students have good nutrition practices (Table 8).

Table 8 – Nutrition practices of NEFU students

Food groups	Frequency (%)					
	Never	Once per week	2-3 times per week	4-6 times per week	Once per day	More than once per day
Cereals and grains	13(3.4)	47(12.2)	137(35.7)	78(20.3)	56(14.6)	53(13.8)
Roots and tubers	19(4.9)	113(29.4)	184(47.9)	48(12.50	12(3.1)	8 (2.1)
Vegetables	17(4.4)	103(26.8)	130(33.9)	71(18.5)	38(9.9)	25(6.5)
Fruits	34(8.9)	138(35.9)	125(32.6)	42(10.9	29(7.6)	16(4.2)
Meat	13(3.4)	50 (13.0)	107(27.9)	103(26.8)	58(15.1)	53(13.8)
Eggs	47(12.2)	109(28.4)	123(32.0)	58(15.1)	31(8.1)	16(4.2)
Fish	144(37.5)	167(43.5)	52(13.5)	9(2.3)	5(1.3)	7(1.8)
Legumes, nuts and seeds	211(54.9)	113(29.4)	42(10.9)	6(1.6)	3(0.8)	9(2.3)
Milk and milk products	32(8.3)	111(28.9)	118(30.7)	61(15.9)	37(9.6)	25(6.5)
Oils and fats	29(7.6)	37(9.6)	108(28.1)	77(20.1)	80(20.8)	53(13.8)
Condiments	32(8.3)	64(16.7)	110(28.6)	81(21.1)	53(13.8)	44(11.5)
Soft drinks	49(12.8)	96(25.0)	124(32.3)	61(15.9)	28 (7.3)	26(6.8)
Tea and coffee	44(11.5)	59(15.4)	61(15.9)	55(14.3)	66(17.2)	99(25.8)
Sweets	18 (4.7)	64(16.7)	114(29.7)	86(22.4)	52(13.5)	50(13.0)
Alcohol	273(71.1)	82(21.4)	14 (3.6)	5(1.3)	2 (0,5)	8 (2.1)
Median $\pm$ IQR					48 $\pm$ 7	
Nutrition Practice Level	Good practice				222(57.8)	
	Bad practice				162 (42.2)	

4.1.2.4 Meal pattern of NEFU students

Majority of the respondents (71.9%) preferred both home-made and store-bought food, while only 30 respondents (7.8%) preferred only home-made food. More than half of the respondents (54.4%) skipped meals. Of the study participants who skipped meals, 170 respondents (81.3%) skipped breakfast and 29 respondents (13.9%) skipped lunch. Most respondents (97.9%) ate snacks. Among respondents who ate snacks, 241 respondents (43.7%) ate baked pastries and sweets, and 143 respondents (26.0%) ate fruits. While cooking or eating food, 257 respondents (66.9%) “always” added salt to food, and 93 respondents (24.2%) added salt “usually.” More than half of the respondents (61.5%) took dietary vitamin and mineral supplements. Among respondents who took dietary vitamin and mineral supplements, 76 respondents (29.9%) took vitamin D and 69 respondents (27.2%) took omega-3 fatty acids (Table 9).

Table 9 – Meal pattern of the students

Variable		Frequency	Percent (%)
Food preference	Only home-cooked food	30	7.8
	Only purchased food	78	20.3
	Both	276	71.9
Skipped meal	No	175	45.6
	Yes	209	54.4
Type of skipped meal	Breakfast	170	81.3
	Lunch	29	13.9
	Dinner	10	4.8
Snacks between meals	No	8	2.1
	Yes	376	97.9
Favorite snack*	Fast Food	131	23.8
	Pastries and sweets	241	43.7
	Fruits	143	26.0
	Nuts and seeds	36	6.5
Added salt to food	Always	257	66.9
	Usually	93	24.2
	Sometimes	20	5.2
	Rarely	10	2.6
	Never	4	1.0
Dietary supplement	No	148	38.5
	Yes	236	61.5
Type of dietary supplement *	Multivitamin	48	18.9
	Vitamin D	76	29.9
	Omega-3	69	27.2
	Calcium	27	10.6
	Vitamin C	34	13.4

Note: *Multiple response question (the respondents may choose any options that apply to them).

4.1.2.5 Eating Behavior of NEFU students

Based on the prevalence of eating behaviors, 67% of NEFU students had EmEB, 44% of university students had REB, and 69% of university students had ExEB [74]. The assessment of the three categories of eating behavior are presented in Figure 9.

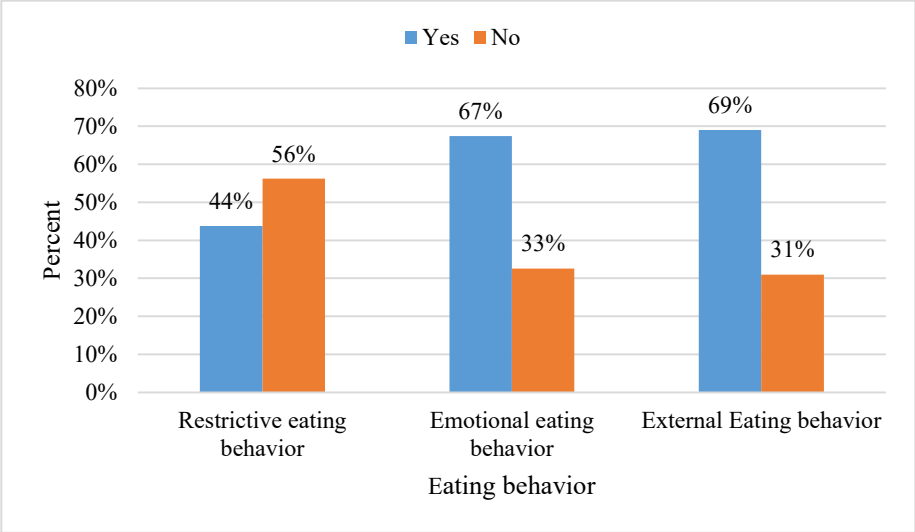


Figure 9 – Prevalence of eating behavior among NEFU students

4.1.3 Health status and lifestyle characteristics of NEFU students

In the current study, about 5.4% of study participants reported excellent health status and 8.1% reported poor health status. Regarding the smoking status of the study participants, about 23.4% of the study participants smoked cigarettes. The prevalence of anxiety and depression symptoms among study participants was 14.6%. Depending on social support, 45.0% of the study participants had strong social support, and 12.8% had poor social support. About 43% of students had low levels of physical activity, and 13.8% had high levels of physical activity. Regarding sitting time, 41.9% of NEFU students sat more than 6 hours per day, and 23.7% sat less than four hours per day (Table 10).

Table 10 – Health status and lifestyle characteristics of NEFU students

Variable		Frequency (%)
Self-rated health	Poor	31 (8.1)
	Satisfactory	147 (38.3)
	Good	149 (38.8)
	Very good	36 (8.4)
	Excellent	21 (5.4)
Sought medical help	Yes	143(37.2)
	No	241 (62.8)
Sleep duration	<7 hours/day	139 (36.2)
	7-8 hours/day	210 (54.7)
	≥9 hours/day	35 (9.1)
Smoking status	Yes	90 (23.4)
	No	294(76.6)

Continuation of Table 10

Parental history of overweight and obesity	Yes	136 (56.3)
	No	216 (35.4)
	Don't know	32 (8.3)
Psychological distress	No	328 (85.4)
	Yes	56 (14.6)
Social support	Poor	49 (12.8)
	Moderate	162 (42.2)
	Strong	173 (45.0)
Physical activity	Low	165 (43.0)
	Moderate	166 (43.2)
	High	53 (13.8)
Sitting time	≤3hours/day	91 (23.7)
	4-6 hours/day	132 (34.4)
	>6 hours/day	161 (41.9)

4.1.4 Prevalence of overweight and obesity among NEFU students

Among NEFU students, the prevalence of obesity and overweight was 6.5% and 18.2%, respectively [73]. The prevalence of overweight and obesity among NEFU students is presented in Figure 10.

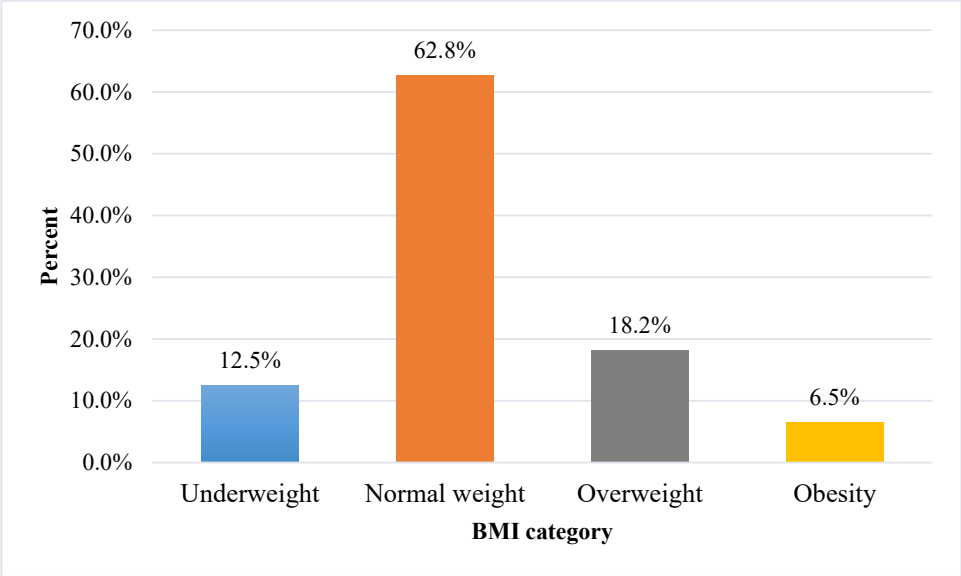


Figure 10 – Prevalence of overweight and obesity among NEFU students

4.1.5 Association between overweight/obesity and study variables

Depending on the gender of NEFU students, the prevalence of overweight and obesity was higher among male students compared to female students. There was a statistically significant relationship between overweight and obesity and the gender of the study participants (X^2=15.81, p=0.001) (Figure 11).

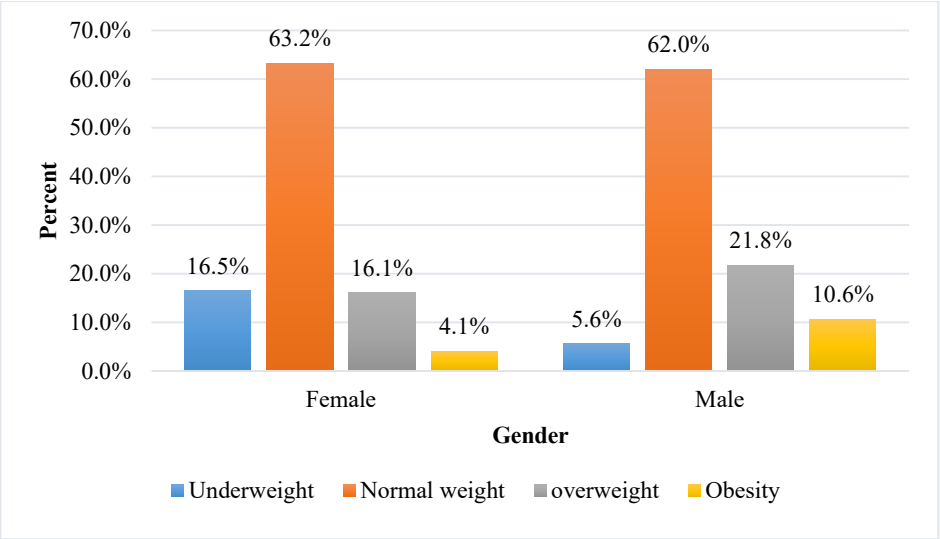


Figure 11 – Prevalence of overweight and obesity among female and male students of NEFU

According to country of origin of the students, Egyptians had the highest prevalence of overweight and obesity (33.4%), followed by Uzbeks (28.6%). However, there was no statistically significant association between overweight and obesity and country of origin (p=0.563) (Figure 12).

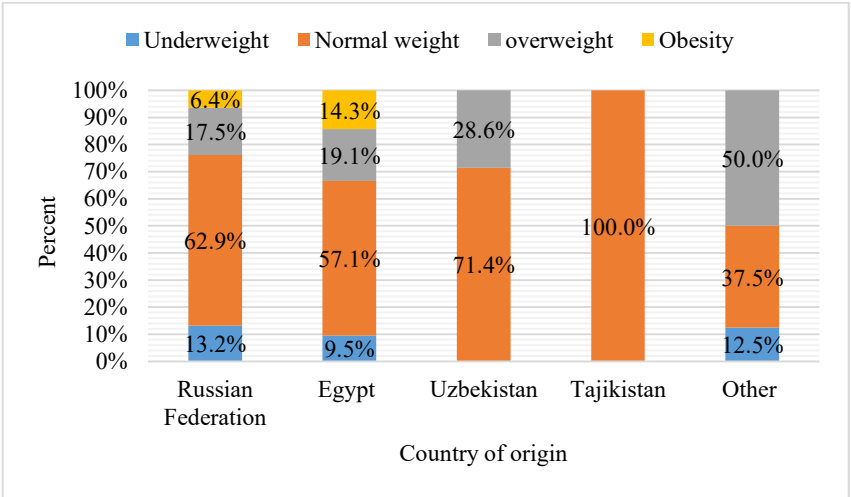
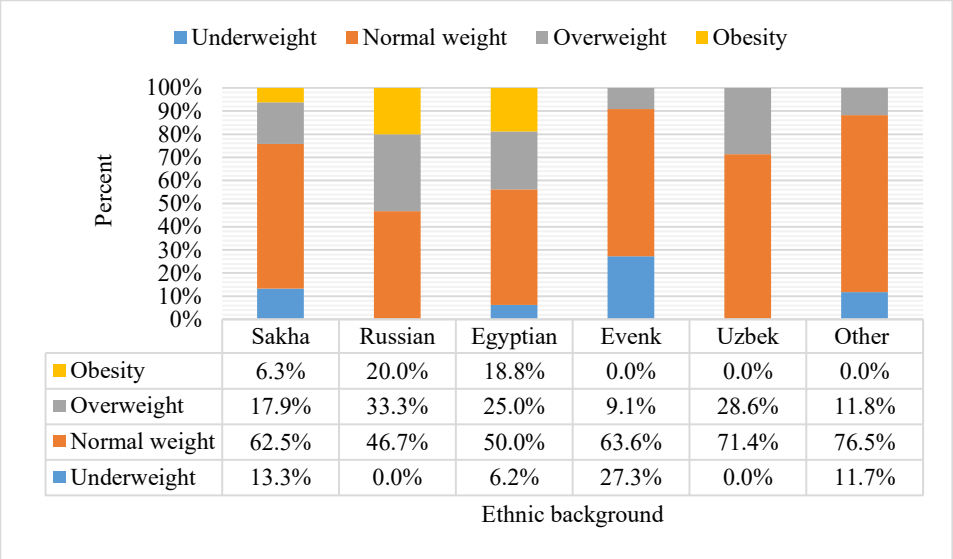


Figure 12 – Prevalence of overweight and obesity among NEFU students by their country of origin

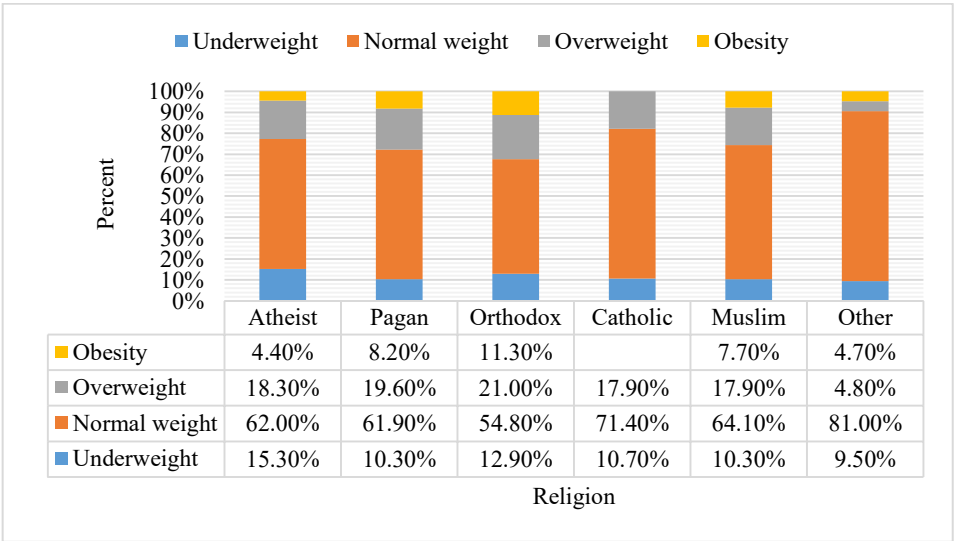
Depending on the ethnic background of study participants, the prevalence of overweight and obesity was higher among ethnic Russians (53.3%), followed by ethnic Egyptians (43.8%). However, there was no statistically significant association between overweight and obesity and the ethnicity of study participants (p>0.05) (Figure 13).



	Sakha	Russian	Egyptian	Evenk	Uzbek	Other
Obesity	6.3%	20.0%	18.8%	0.0%	0.0%	0.0%
Overweight	17.9%	33.3%	25.0%	9.1%	28.6%	11.8%
Normal weight	62.5%	46.7%	50.0%	63.6%	71.4%	76.5%
Underweight	13.3%	0.0%	6.2%	27.3%	0.0%	11.7%

Figure 13 – Prevalence of overweight and obesity among NEFU students by ethnic background

Based on the religion of NEFU students, the prevalence of overweight and obesity was higher among Orthodox Christians (32.3%), followed by Pagans (27.8%) and Muslims (25.6%). However, there was no statistically significant association between overweight and obesity and religion of study participants (p=0.742) (Figure 14).



	Atheist	Pagan	Orthodox	Catholic	Muslim	Other
Obesity	4.40%	8.20%	11.30%		7.70%	4.70%
Overweight	18.30%	19.60%	21.00%	17.90%	17.90%	4.80%
Normal weight	62.00%	61.90%	54.80%	71.40%	64.10%	81.00%
Underweight	15.30%	10.30%	12.90%	10.70%	10.30%	9.50%

Figure 14 – Prevalence of overweight and obesity among NEFU students by their religion

The prevalence of overweight and obesity was higher among married students (38.5%) compared to unmarried students (23.8%). However, there was no statistically significant relationship between overweight and obesity and the marital status of the study participants (p=0.117) (Figure 15).

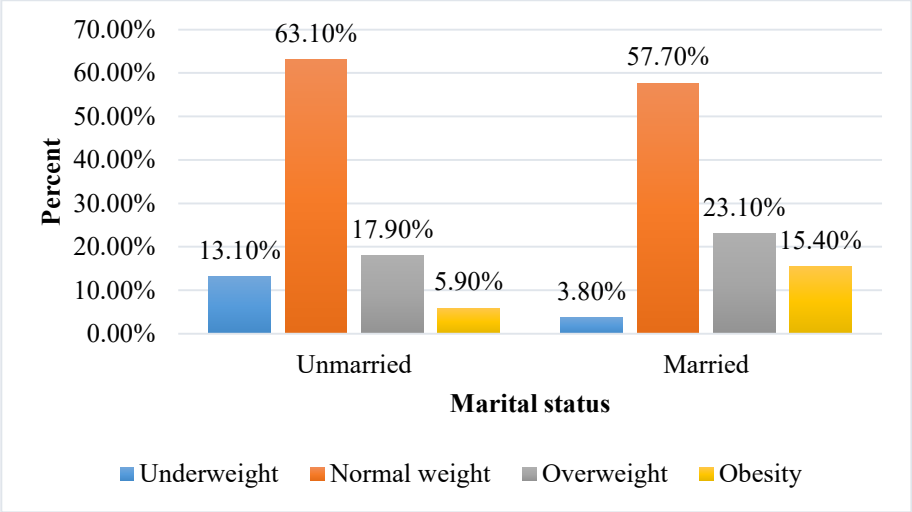


Figure 15 – Prevalence of overweight and obesity among NEFU students by marital status

Based on institute of study , the prevalence of overweight and obesity was highest among students at institute of natural sciences (28.6%) followed by students at institute of physical culture and sports (27.2%) and students at the medical institute 25.6%). However, there was no statistically significant association between overweight and obesity and institute of the study participants (p=0.583) (Figure 16).

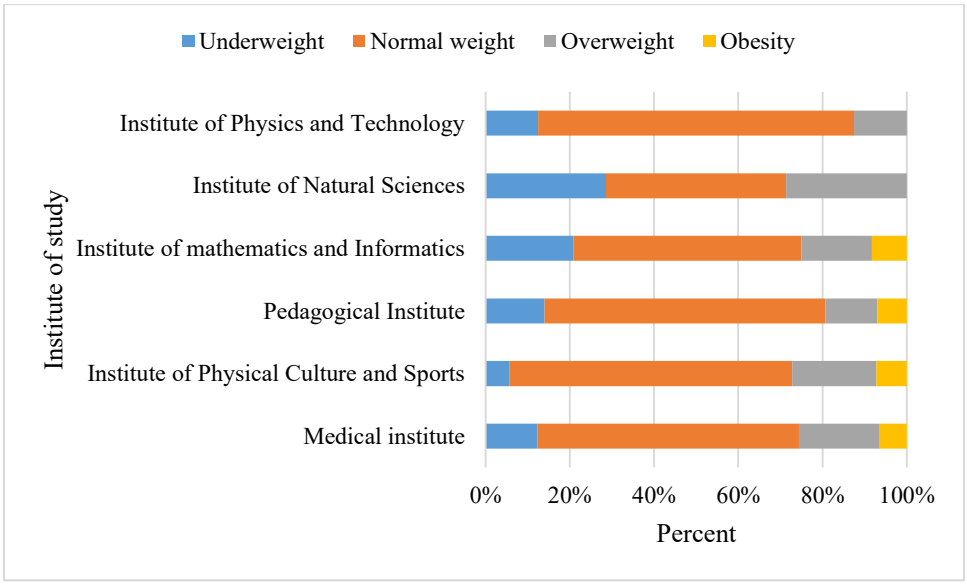


Figure 16 – Prevalence of overweight and obesity among NEFU students by institute of study

Based on year of study, the prevalence of overweight and obesity was highest among second-year students (26.8%), followed by first-year students (25.1%) (Figure 17).

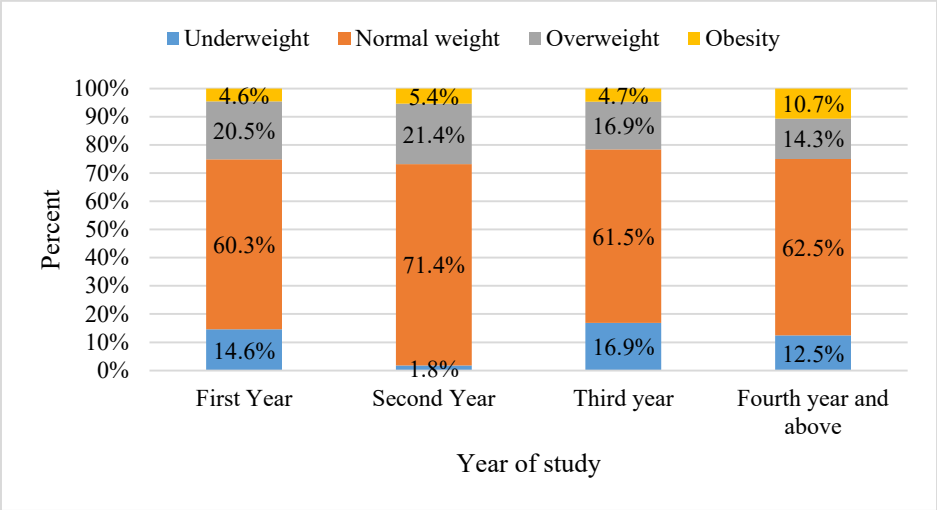


Figure 17 – Prevalence of overweight and obesity among NEFU students by year of study

Depending on the educational status of the mother, the prevalence of overweight and obesity was highest among students who had mothers with primary education (75%) followed by students who had mothers with no education (27.7%). However, there was no statistically significant association between overweight and obesity among NEFU students and educational status of the mother respectively ($p>0.05$) (Figure 18).

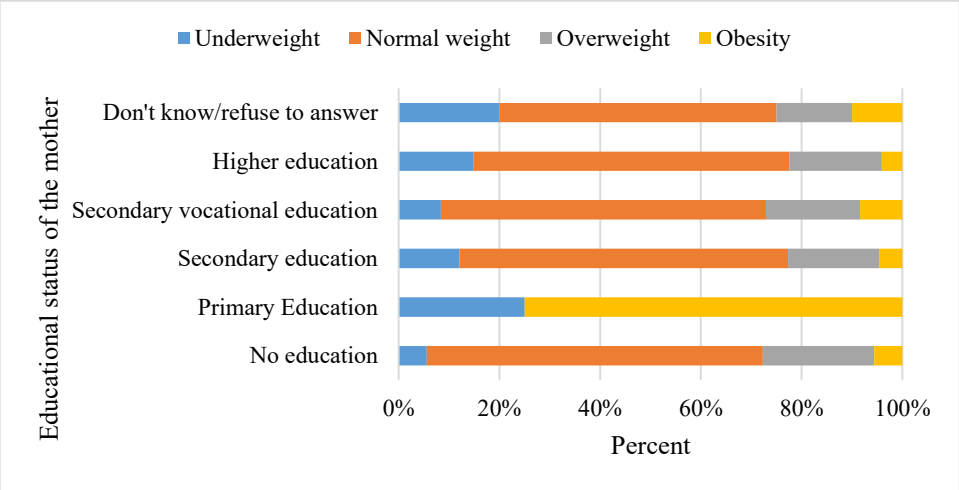


Figure 18 – Prevalence of overweight and obesity among NEFU students depending on the educational status of the mother

Based on the educational status of the father, the prevalence of overweight and obesity was highest among students whose fathers had a high school education (32.2%), followed by students whose fathers had a high school education (21.6%). However, there was no statistically significant association between overweight and obesity and the educational status of the father (p = 0.508) (Figure 19).

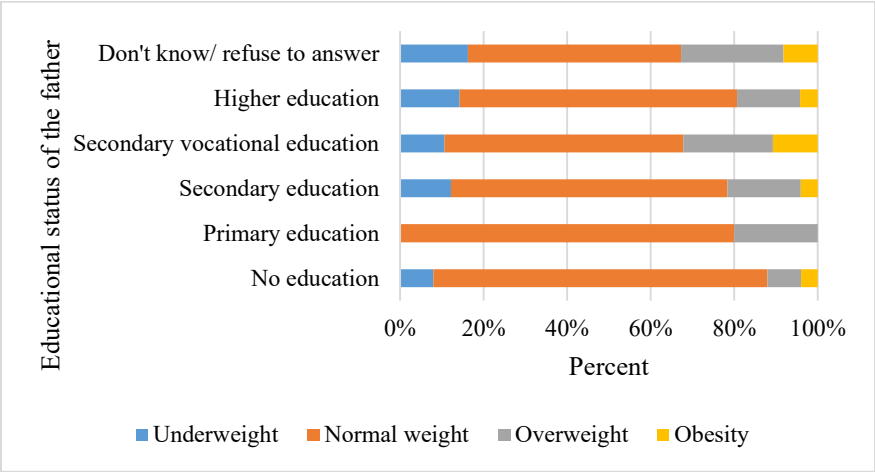


Figure 19 – Prevalence of overweight and obesity among NEFU students depending on the educational status of the father

Based on employment status of the mother, the prevalence of overweight and obesity was highest among students with pensioner mothers (31.1%), followed by students with employed mothers (21.4%) and unemployed mothers (21.2%) (Figure 20).

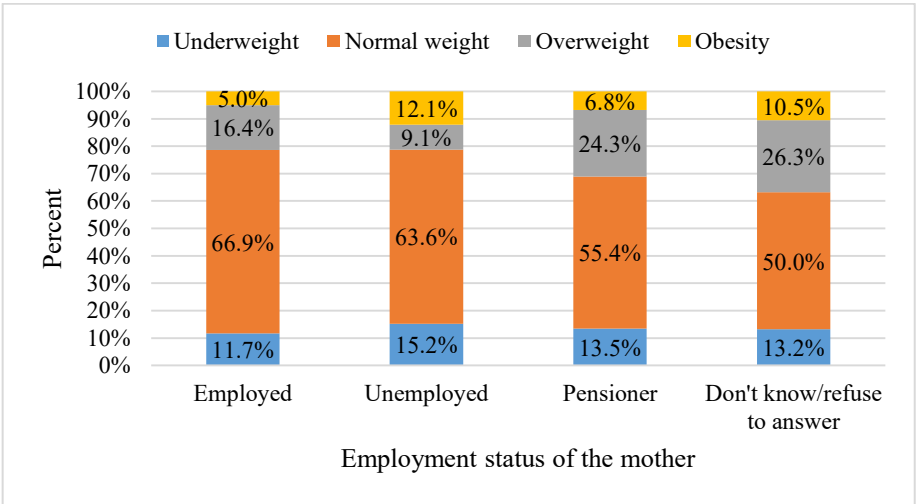


Figure 20 – Prevalence of overweight and obesity among NEFU students depending on the employment status of the mother

Based on the employment status of the father, the prevalence of overweight and obesity was highest among students with pensioner fathers (31.5%), followed by students with employed fathers (20.7%) (Figure 21).

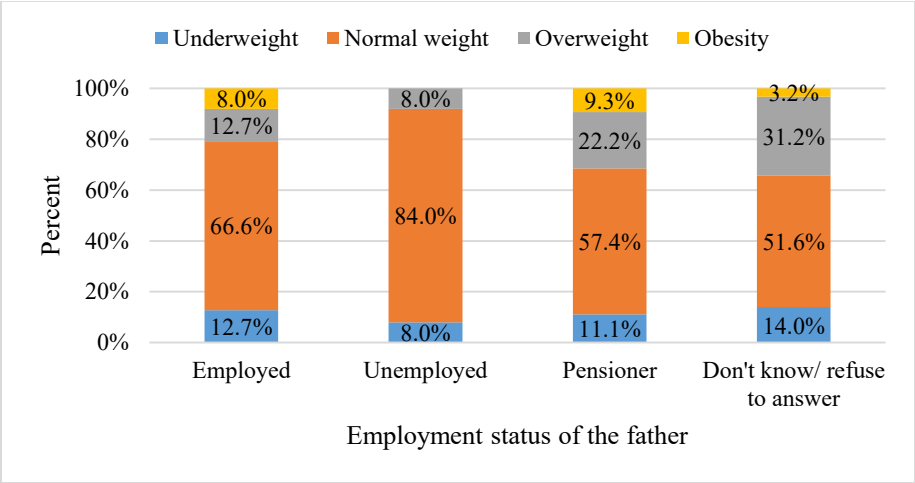
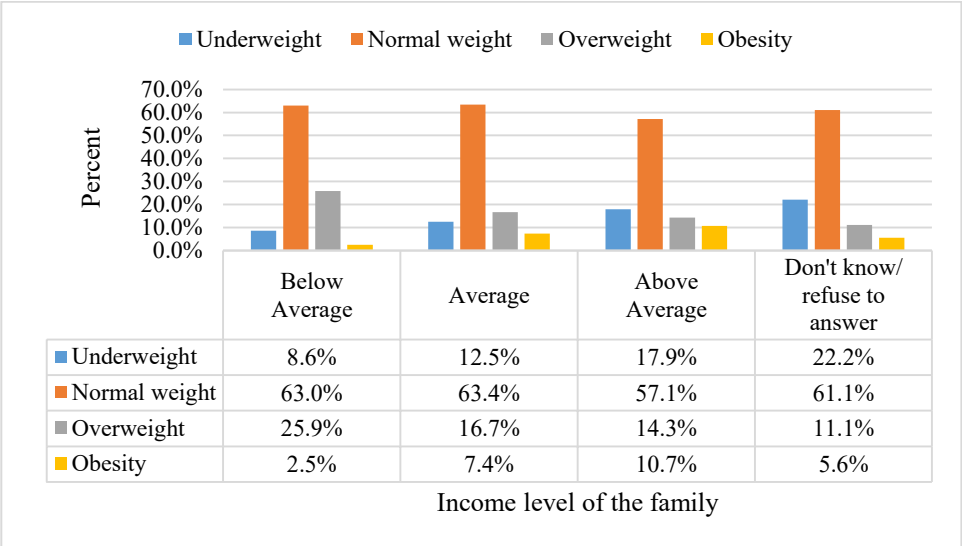


Figure 21 – Prevalence of overweight and obesity among NEFU students by the employment status of the father

Based on the income level of the family, the prevalence of overweight and obesity was highest among students with below-average family income (28.4%), followed by students with above-average family income (25.0%). However, no statistically significant association was found between being overweight and obesity and income level of the family (p=0.328) (Figure 22).



	Below Average	Average	Above Average	Don't know/ refuse to answer
Underweight	8.6%	12.5%	17.9%	22.2%
Normal weight	63.0%	63.4%	57.1%	61.1%
Overweight	25.9%	16.7%	14.3%	11.1%
Obesity	2.5%	7.4%	10.7%	5.6%

Figure 22 – Prevalence of overweight and obesity among NEFU students by income level of the family

Depending on the opportunity to earn extra money, the prevalence of overweight and obesity was higher among university students who had the opportunity to earn extra money (26.1%) compared to NEFU students who did not have the opportunity to earn extra money (22.9%). However, no statistically significant relationship was found between the opportunity to earn extra money and overweight and obesity among NEFU students (X^2=1.277, p=0.735) (Figure 23).

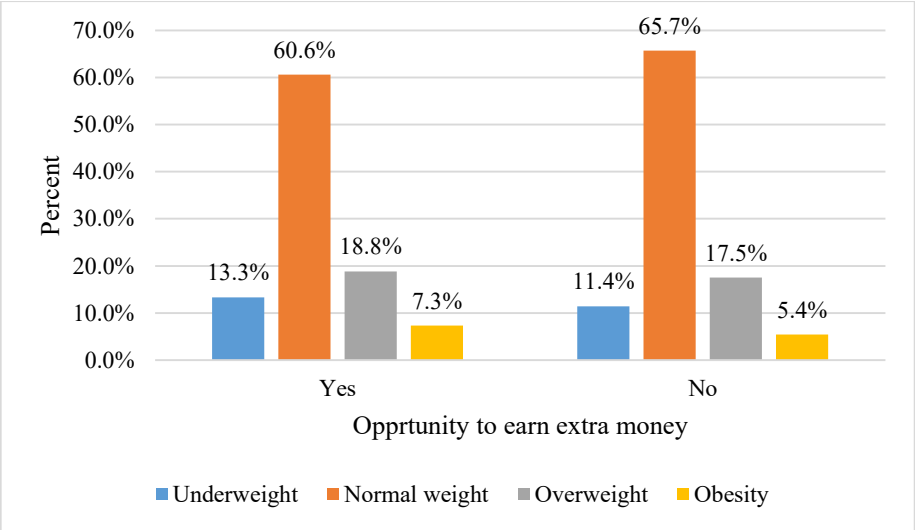


Figure 23 – Prevalence of overweight and obesity among NEFU students depending on the opportunity to earn extra money

Based on the residence of students, the prevalence of overweight and obesity was slightly higher among students who lived outside university dormitory (25.9%) as compared to students who lived in university dormitory (24.1%). However, there was no statistically significant association between overweight and obesity and residence of students (X^2 =3.49, p=0.322) (Figure 24).

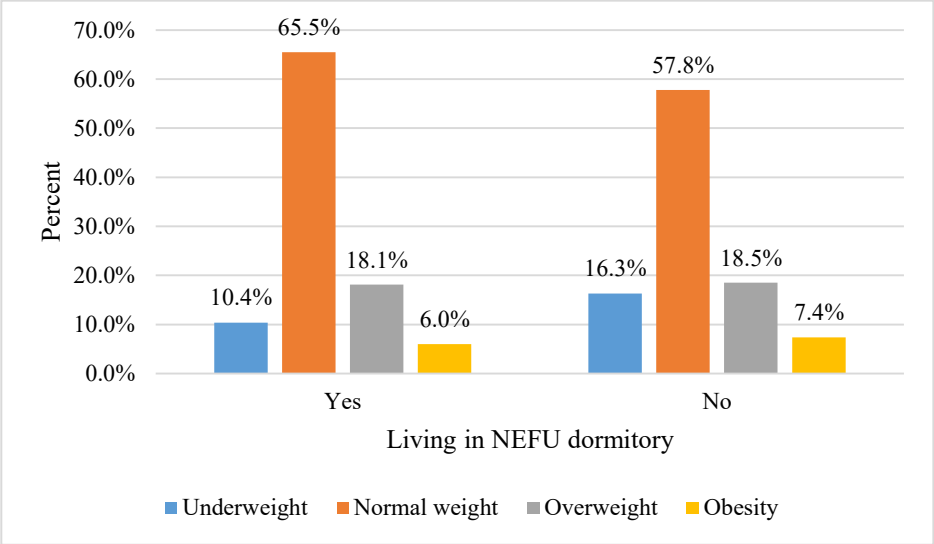


Figure 24 – Prevalence of overweight and obesity among NEFU students at their place of residence

Based on the satisfaction of students with NEFU services, the prevalence of overweight and obesity was almost the same among students who were satisfied with NEFU services and students who were not satisfied with NEFU services (Figure 25).

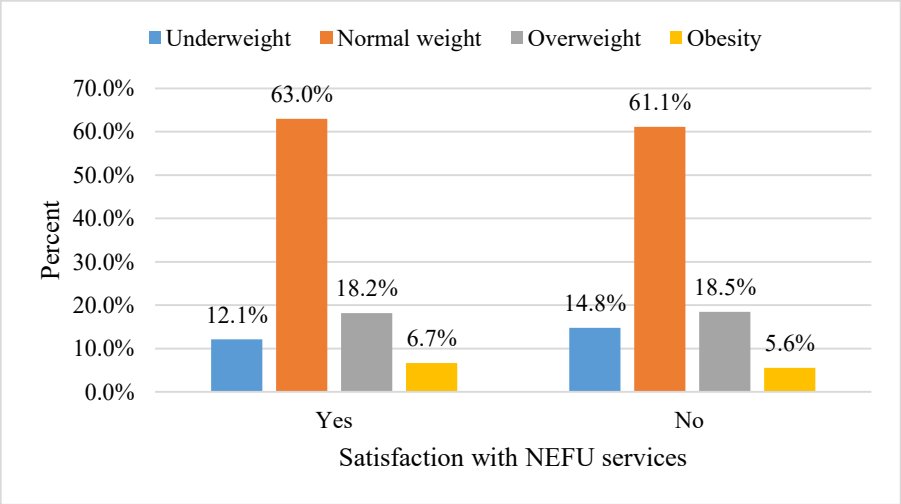


Figure 25 – Prevalence of overweight and obesity among NEFU students based on satisfaction with NEFU services

Based on nutrition knowledge of students, the prevalence of overweight and obesity was higher among students who had poor nutrition knowledge (27.1%) compared to students who had good nutrition knowledge (22.4%). However, there was no statistically significant relationship between overweight and obesity and students' knowledge about nutrition (X^2=1.24, p=0.745) (Figure 26).

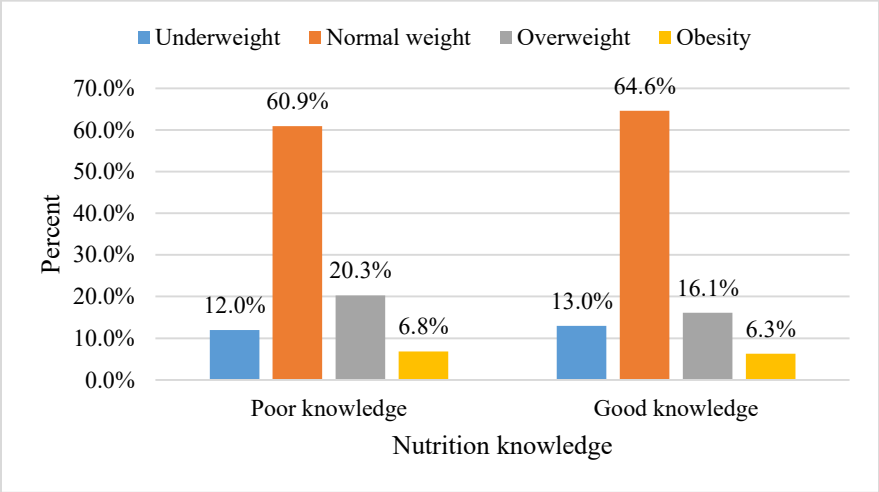


Figure 26 – Prevalence of overweight and obesity among NEFU students by the level of nutrition knowledge

Based on the attitudes towards nutrition of students, the prevalence of overweight and obesity was higher among students with negative attitudes towards nutrition (29.8%) compared to students with positive attitudes towards nutrition (20.4%) (Figure 27).

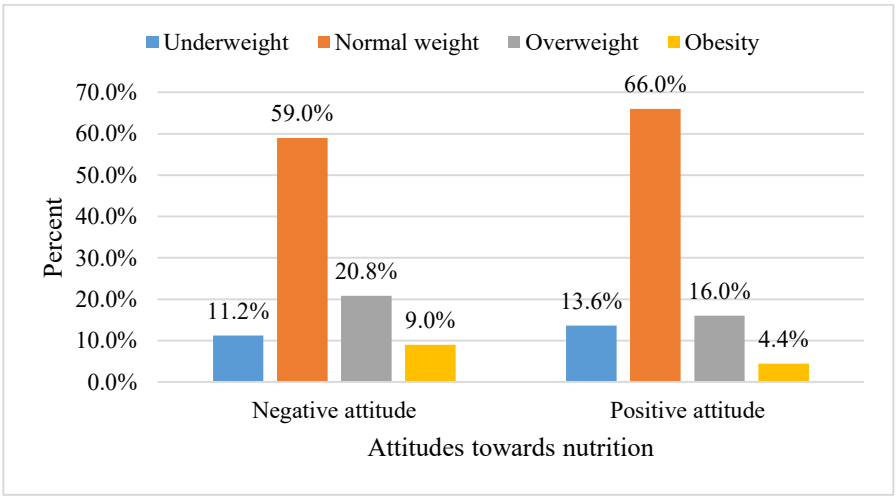


Figure 27 – Prevalence of obesity and overweight among NEFU students depending on their attitudes towards nutrition

Based on nutritional practices, the prevalence of obesity and overweight was higher among students who had poor nutritional practices (27.8%) compared to students who had good nutritional practices (22.5%) (Figure 28).

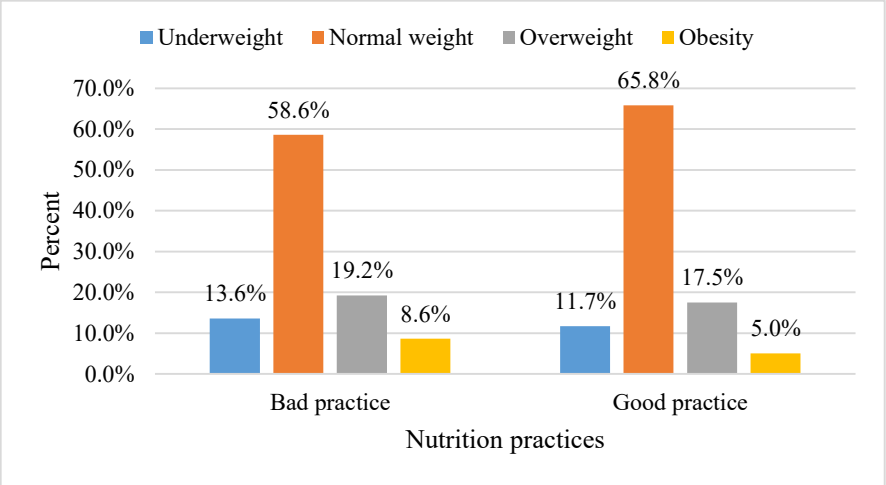


Figure 28 – Prevalence of overweight and obesity among NEFU students by practices towards nutrition

Depending on food preferences, the prevalence of overweight and obesity was highest among students who preferred to eat only purchased foods (34.6%) and lowest among students who preferred to eat only home-cooked foods (13.3 %) (Figure 29).

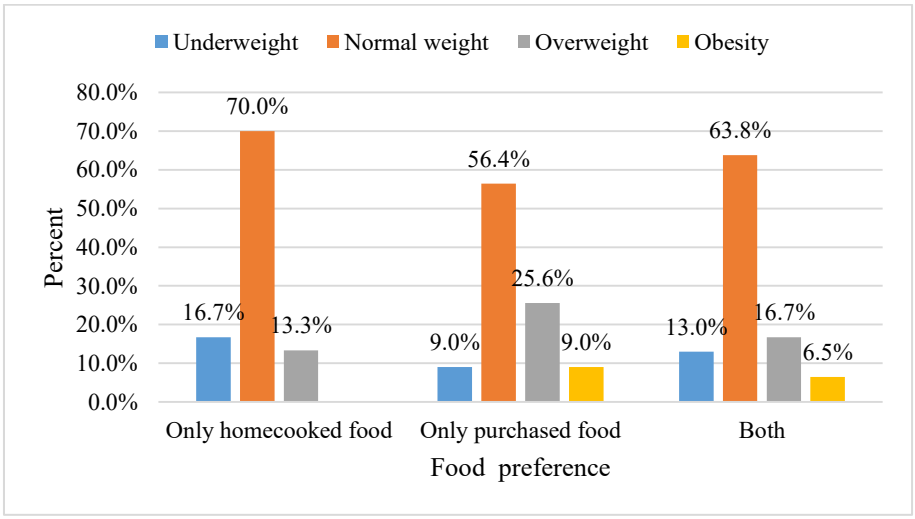


Figure 29 – Prevalence of overweight and obesity among NEFU students by food preferences

Depending on skipping meals, the prevalence of overweight and obesity was higher among students who skipped meals (25.7%) compared to students who did not skip meals (23.5%). However, there was no statistically significant relationship between overweight and obesity (X^2=3.63; p=0.304) (Figure 30).

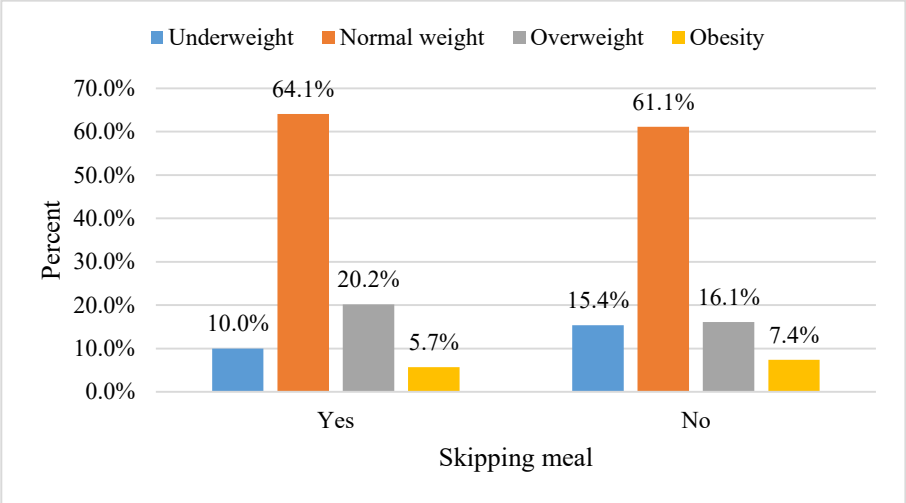


Figure 30 – Prevalence of overweight and obesity among NEFU students by skip meals

Depending on the type of meal skipping, the prevalence of overweight and obesity was highest among students who skipped lunch (31.0%) and dinner (30.0%) (Figure 31).

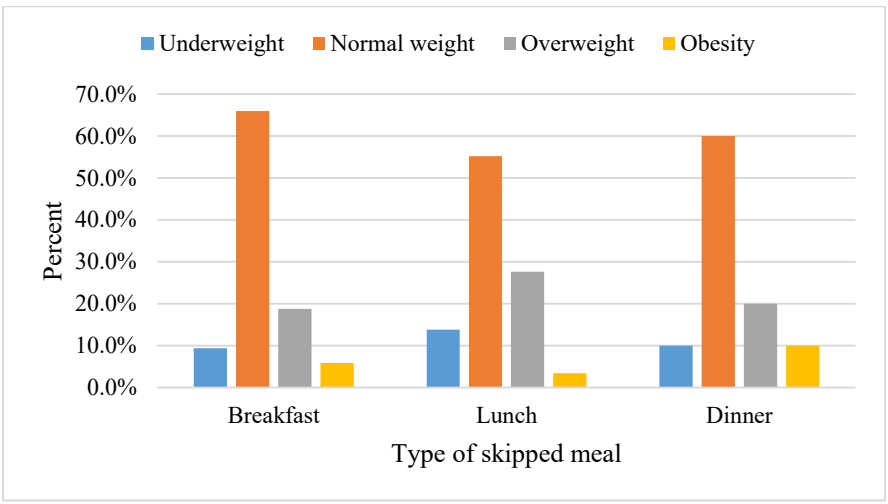


Figure 31 – Prevalence of overweight and obesity among NEFU students by the type of skipped meal

Depending on snack consumption, the prevalence of overweight and obesity was highest among students who consumed snacks (25.0%) compared to students who did not consume snacks (12.5%) (Figure 32).

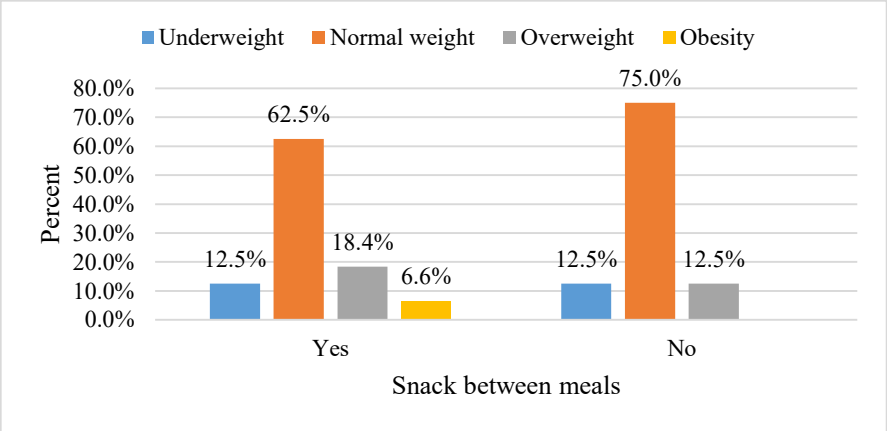
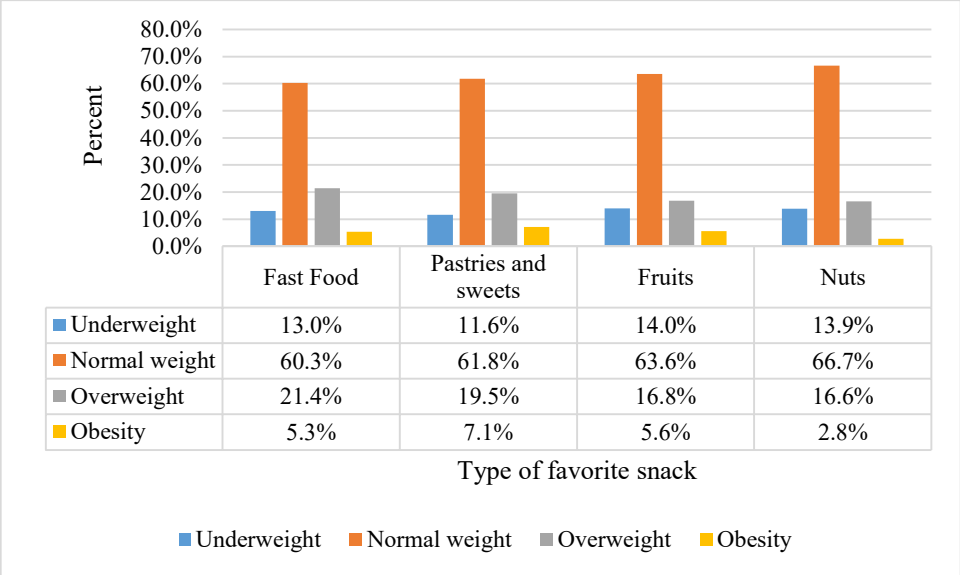


Figure 32 – Prevalence of overweight and obesity among NEFU students by snack consumption

Depending on the type of favorite snack, the combined prevalence of overweight and obesity was highest among students who consumed fast foods (26.7%) and pastries and sweets (26.6%), while it was lowest among students who consumed nuts (19.4%) (Figure 33).



	Fast Food	Pastries and sweets	Fruits	Nuts
Underweight	13.0%	11.6%	14.0%	13.9%
Normal weight	60.3%	61.8%	63.6%	66.7%
Overweight	21.4%	19.5%	16.8%	16.6%
Obesity	5.3%	7.1%	5.6%	2.8%

Figure 33 – Prevalence of overweight and obesity among NEFU students by the type of favorite snack

Based on the frequency of adding salt to food, the prevalence of overweight and obesity was highest among students who “usually” added salt to food and was zero among students who “never” added salt to food (Figure 34).

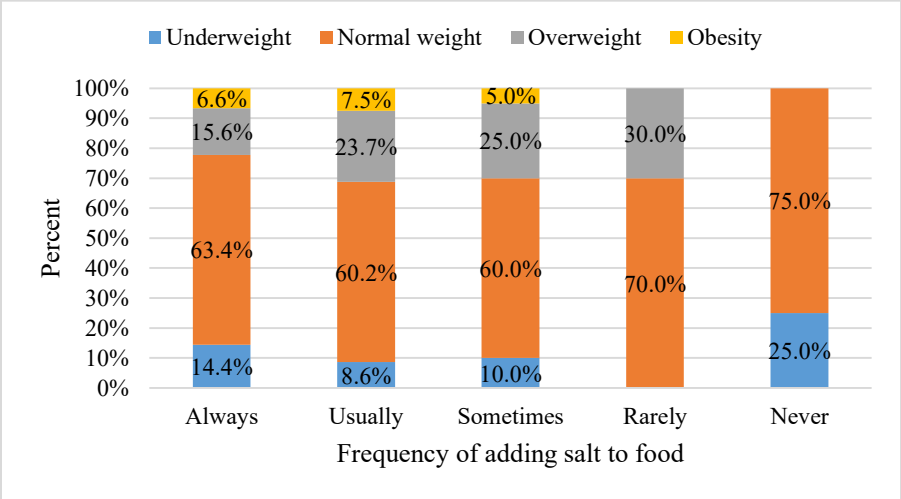


Figure 34 – Prevalence of overweight and obesity among NEFU students by frequency of adding salt to food

Based on the use of vitamin and mineral supplements, the prevalence of overweight and obesity was lower among students using vitamin and mineral supplements (Figure 35).

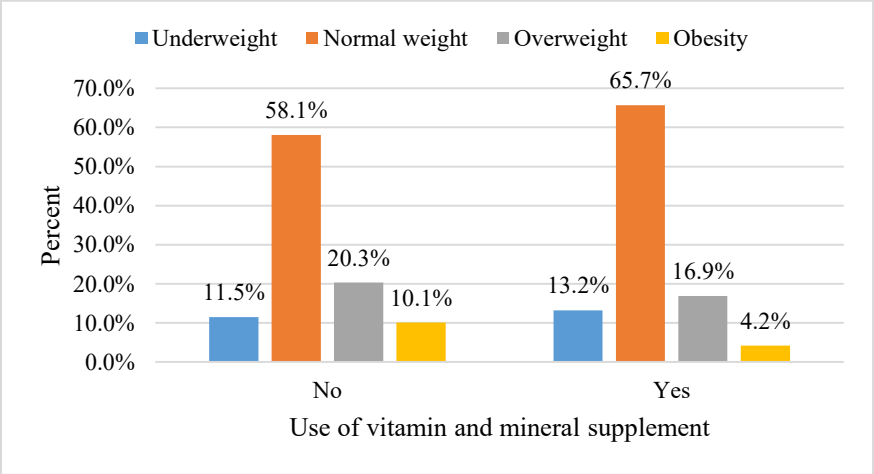


Figure 35 – Prevalence of overweight and obesity among NEFU students based on the use of vitamin and mineral supplements

Depending on the type of vitamin or mineral supplement used, the prevalence of overweight and obesity was lowest among students taking calcium supplements, followed by students taking multivitamin supplements (Figure 36).

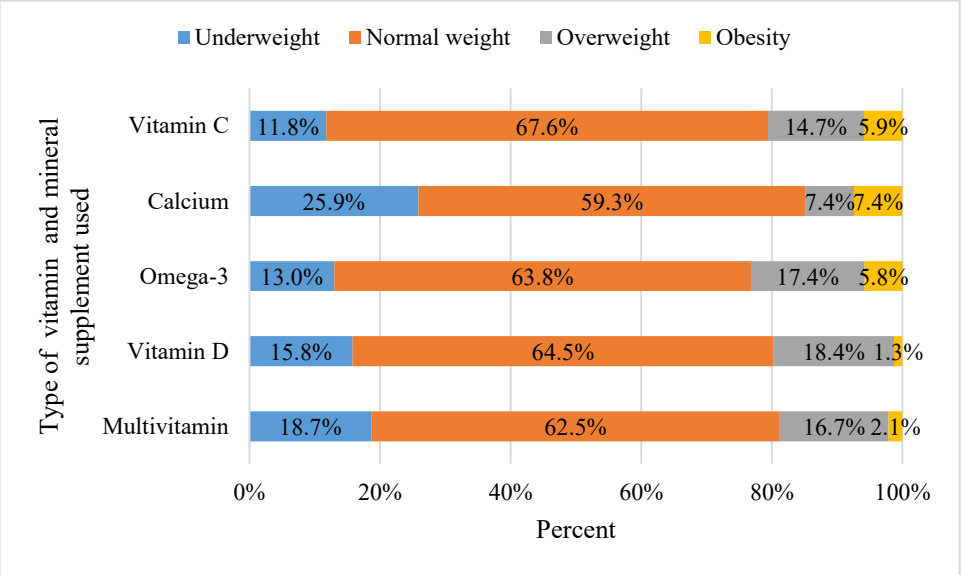


Figure 36 – Prevalence of overweight and obesity among NEFU students by type of vitamin and mineral supplements used

Depending on the REB of students, the prevalence of overweight and obesity was higher among students with REB as compared to students without REB. There was a statistically significant association between the prevalence of overweight and obesity and the REB of the students (X^2=23.27,p<0.001) (Figure 37).

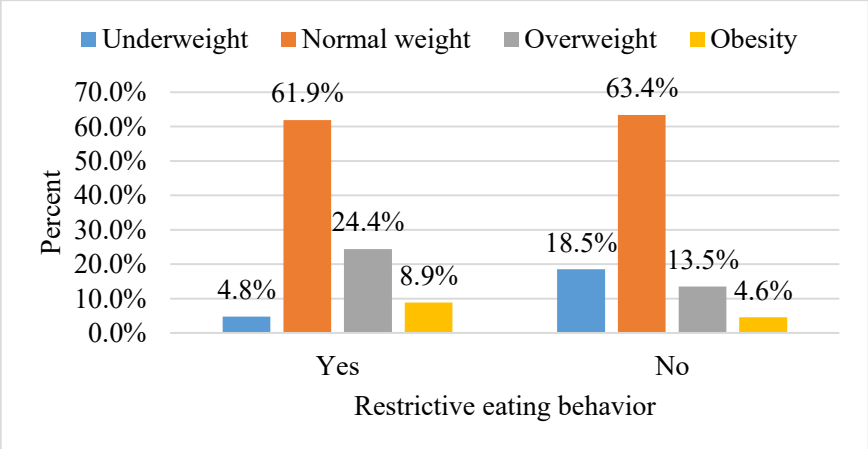


Figure 37 – Prevalence of overweight and obesity among NEFU students depending on REB

Depending on EmEB, the prevalence of overweight and obesity was higher among students with EmEB as compared to students without EmEB (Figure 38).

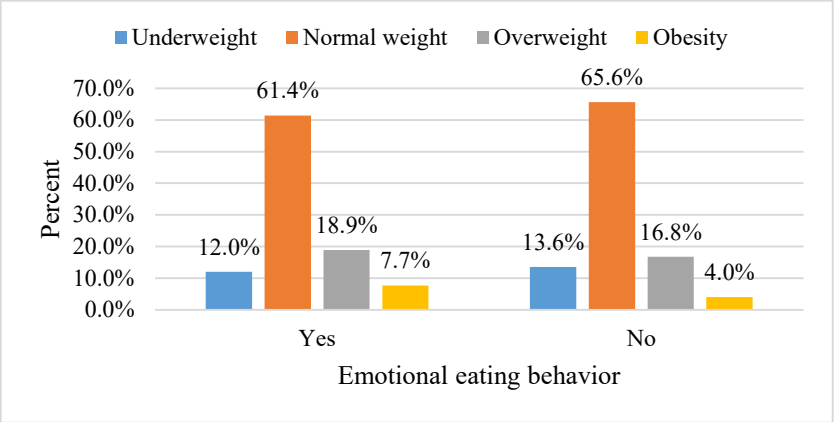


Figure 38 – Prevalence of overweight and obesity among NEFU students depending on EmEB

Depending on ExEB, the prevalence of overweight and obesity was higher among students with ExEB as compared to students without ExEB. However, there was no statistically significant association between overweight and obesity and ExEB (X^2=0.329, p=0.955) (Figure 39).

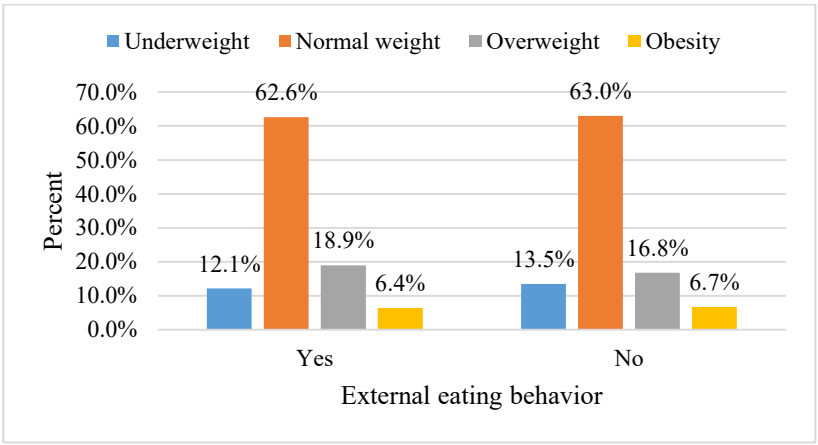


Figure 39 – Prevalence of overweight and obesity among NEFU students depending on ExEB

Based on self-rated health status, the prevalence of overweight and obesity was highest among students with “poor” health status (29.0%), while it was lowest among students with “excellent” health status (9.5%). However, there was no statistically significant relationship between overweight and obesity and self-rated health status of NEFU students (p = 0.146 (Figure 40).

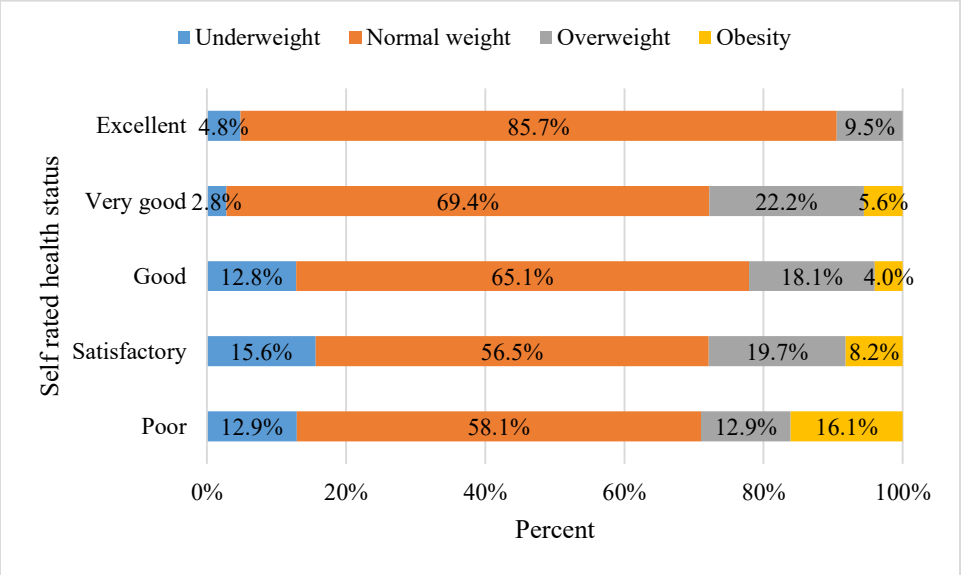


Figure 40 – Prevalence of overweight and obesity among NEFU students based on self- rated health status

Based on health seeking characteristics, the prevalence of overweight and obesity was lower among students who sought medical help as compared to students who did not sought medical help. However, there was no statistically significant association between overweight and obesity and health seeking behavior of the students (X^2=1.67, p=0.642) (Figure 41).

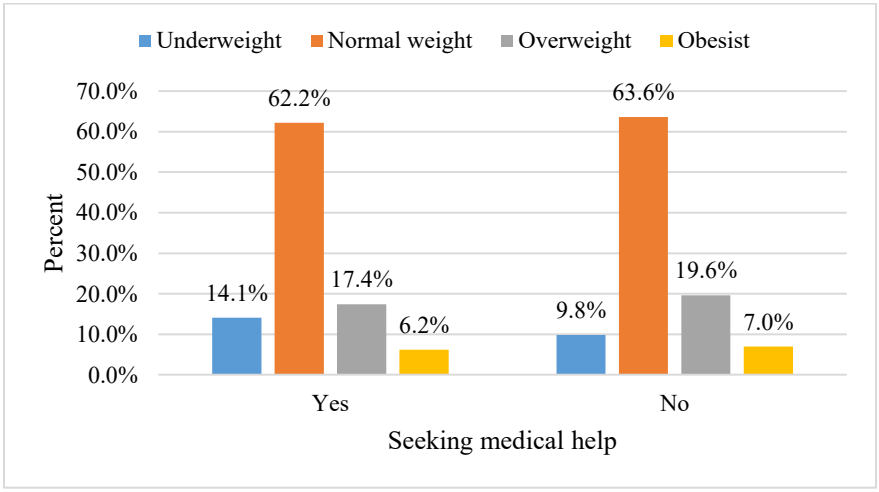


Figure 41 – Prevalence of overweight and obesity among NEFU students based on seeking medical help

Depending on sleep duration, the combined prevalence of overweight and obesity was highest among students who slept less than 7 hours per night (Figure 42).

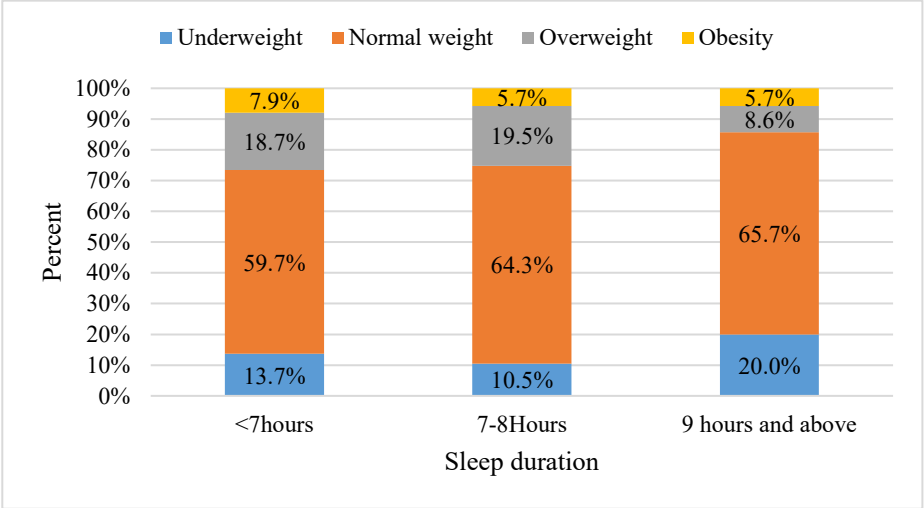


Figure 42 – Prevalence of overweight and obesity among NEFU students by sleep duration

Depending on the smoking status, the prevalence of overweight and obesity was higher among smoking students as compared to non-smoking students. However, there was no statistically significant association between overweight and obesity and smoking status of NEFU students (X^2=4.21, p=0.24) (Figure 43).

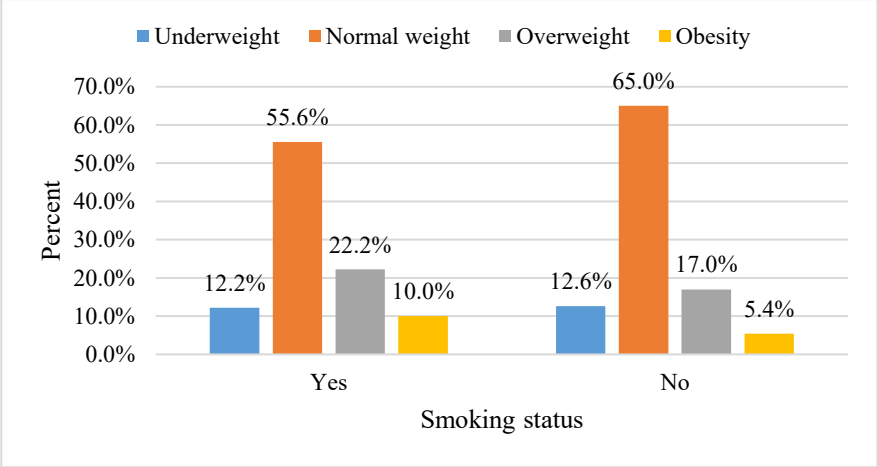


Figure 43 – Prevalence of overweight and obesity among NEFU students by smoking status

Based on family history of overweight and obesity, the prevalence of overweight and obesity was highest among students with a family history of overweight and obesity. However, there was no statistically significant relationship between overweight and obesity among NEFU students and a family history of overweight and obesity (X^2=7.77, p=0.255) (Figure 44).

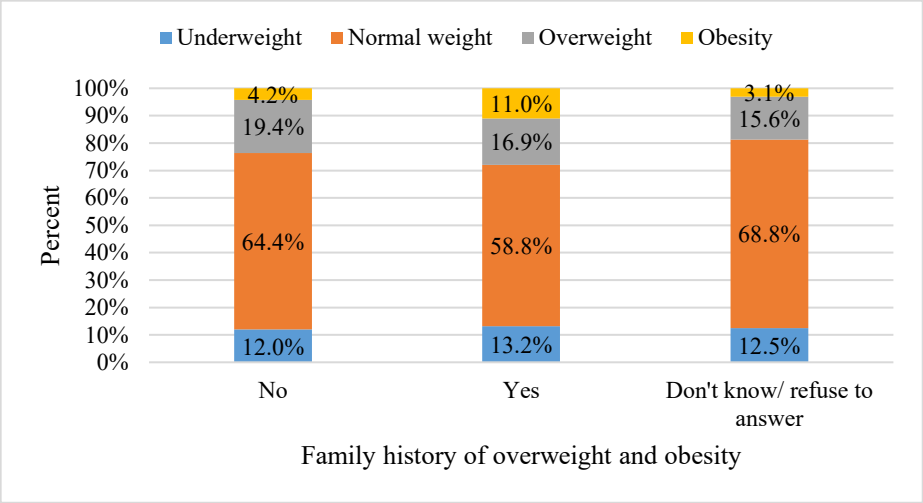


Figure 44 – Prevalence of overweight and obesity among NEFU students based on family history of overweight and obesity

Depending on the psychological distress, the prevalence of overweight and obesity was higher among students with psychological distress (35.7%) compared to students without psychological distress (22.9%) (Figure 45).

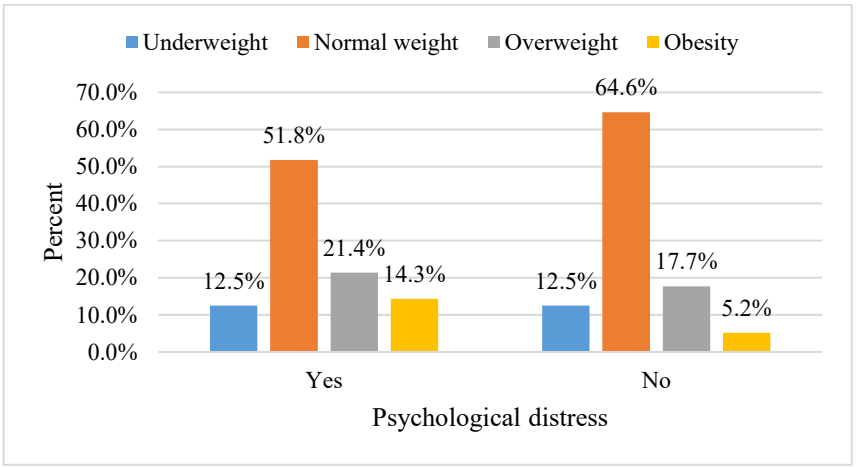


Figure 45 – Prevalence of overweight and obesity among NEFU students depending on psychological distress

Based on social support, the combined prevalence of overweight and obesity was highest among students with poor social support (36.8%), while it was lowest among students with strong social support (21.3%). There was a statistically significant relationship between overweight and obesity among NEFU students and social support (X^2=14.61, p=0.024) (Figure 46).

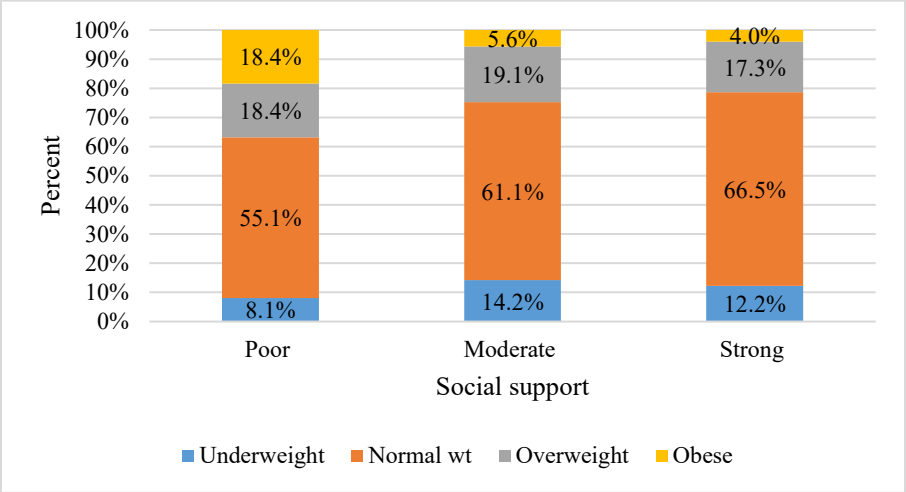


Figure 46 – Prevalence of overweight and obesity among NEFU students based on social support

Based on physical activity, the prevalence of overweight and obesity was highest among students with low levels of physical activity (39.4%) and lowest among students with high levels of physical activity (7.6%). A statistically significant relationship was found between overweight and obesity among university students and physical activity (X^2=40.34, p<0.001) (Figure 47).

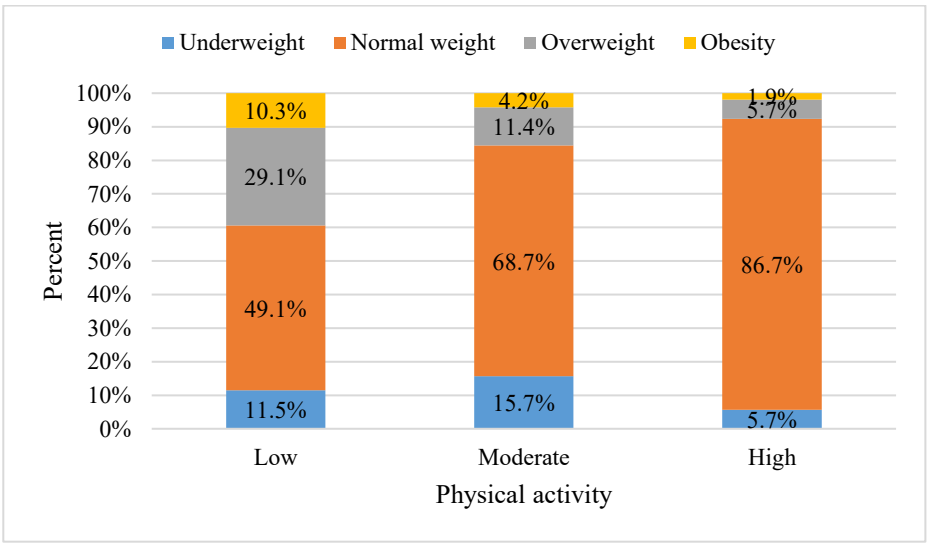


Figure 47 – Prevalence of overweight and obesity among NEFU students by physical activity

Based on sitting time, the combined prevalence of overweight and obesity was highest among university students who sat for more than 6 hours per day (Figure 48).

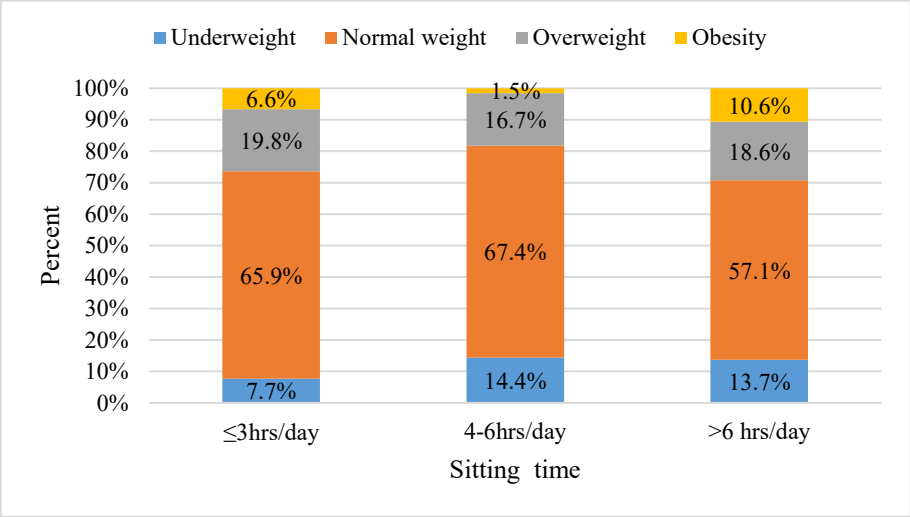


Figure 48 – Prevalence of overweight and obesity among NEFU students by sitting time

4.1.6 Factors associated with overweight and obesity among NEFU students

To identify factors associated with overweight and obesity, both bivariate and multi variable logistic regressions were performed. Variables with a significance level of $p<0.25$ in the bivariate analysis were chosen for potential inclusion in multivariable logistic regression. Variables with a significance level of $p<0.25$ in the bivariate logistic regression were gender, age, marital status, educational status of the father, employment status of the mother, employment status of the father, monthly expenditure on food, attitudes towards nutrition, nutrition practice, food preference, REB, EmEB, health status, sleep duration, smoking status, psychological distress, social support and physical activity level (Table 11).

Table 11 – Bivariate logistic regression of factors associated with overweight and obesity among NEFU students

Variables		Frequency	Non overweight and obesity(n=289)	Overweight and obesity(n=95)	Crude odds ratio (COR) (95% CI)	p
Gender	Female	242	193	49	1	-
	Male	142	96	46	1.887 (1.178-3.023)	0.008
Age (in years)	Mean ±SD	20.93 ± 2.1	20.69± 2.04	21.66± 2.16	1.243 (1.112-1.389)	<0.001
Mariatal status	Married	26	16	10	1	-
	Unmarried	358	273	85	0.498(0.218-1.139)	0.099

Continuation of Table 11

Educational status of the father	No education	25	22	3	1	-
	Primary education	5	4	1	1.833(0.150-22.366)	0.635
	Secondary education	74	58	16	2.023 (0.537-7.628)	0.298
	Secondary vocational education	112	76	36	3.474 (0.976-12.367)	0.055
	Higher education	119	96	23	1.757(0.484-6.378)	0.392
	Don't know	49	33	16	3.556 (0.925-13.660)	0.065
Employment status of the mother	Employed	239	188	51	1	-
	Unemployed	33	26	7	0.992 (0.408-2.417)	0.987
	Pensioner	74	51	23	1.662 (0.929-2.974)	0.087
	Don't know	38	24	14	2.150 (1.038-4.454)	0.039
Employment status of the father	Employed	212	168	44	1	-
	Unemployed	25	23	2	0.332(0.075-1.462)	0.145
	Pensioner	54	37	17	1.754 (0.904-3.405)	0.097
	Don't know	93	61	32	2.003(1.166-3.442)	0.012
Monthly expenditure on food	Mean ±SD	11754.04 ± 5516.5	11517.99± 5389.7	12472.11± 5856.7	1.000 (0.999-1.000)	0.144
Attitudes towards nutrition	Negative	178	125	53	1	-
	Positive	206	164	42	0.604 (0.379-0.964)	0.034
Nutrition practices	Bad	162	117	45	1	-
	Good	222	172	50	0.756(0.474-1.205)	0.239
Food preferences	Only home cooked food	30	26	4	1	-
	Only purchased food	78	51	27	3.441(1.088-10.883)	0.035
	Both	276	212	64	1.962 (0.660-5.831)	0.225
REB	No	216	177	39	1	-
	Yes	168	112	56	2.269 (1.415-3.639)	<0.001
EmEB	No	125	99	26	1	-
	Yes	259	190	69	1.383(0.828-2.308)	0.215
Health status	Poor	31	22	9	1	-
	Satisfactory	147	106	41	0.945 (0.402-2.224)	0.898
	Good	149	116	33	0.695(0.292-1.654)	0.411
	Very good	36	26	10	0.940(0.324-2.726)	0.910
	Excellent	21	19	2	0.257 (0.049-1.341)	0.107

Continuation of Table 11

Sleep duration	<7 hours	139	102	37	1	-
	7-8 hours	210	157	53	0.931 (0.571-1.516)	0.773
	9 hours and bove	35	30	5	0.459 (0.166-1.273)	0.135
Smoking status	No	294	228	66	1	-
	Yes	90	61	29	1.642 (0.976-2.763)	0.062
Psychological distress	No	328	253	75	1	-
	Yes	56	36	20	1.874(1.024-3.430)	0.042
Social support	Poor	49	31	18	1	-
	Moderate	162	122	40	0.565(0.286-1.117)	0.100
	Strong	173	136	37	0.469 (0.236-0.930)	0.030
Physical activity	Low	165	100	65	1	-
	Moderate	166	140	26	0.286 (0.169-0.482)	<0.001
	High	53	49	4	0.126 (0.043-0.365)	<0.001

Note: SD- Standard deviation, p - level of statistical significance.

Multicollinearity (VIF<3) and Hosmer-Lemeshow test (>0.05) were checked before proceeding multivariate analysis. Since VIF is less than 3, Hosmer –Lemeshow test is non-significant and classification table is greater than 50%, the multivariate logistic regression model is a good fit (Table 12).

Table 12 – Multicollinearity and model fit tests for multivariate logistic regression

Dependent variable : Overweight and obesity		
Independent variable	Collinearity Statistics	
	Tolerance	VIF
Gender	0.888	1.126
Age	0.812	1.231
Marital status	0.851	1.175
Educational status of the father	0.944	1.059
Employment status of the mother	0.882	1.134
Employment status of the father	0.897	1.115
Monthly expenditure on food	0.883	1.133
Attitudes towards nutrition	0.920	1.087
Nutrition practices	0.854	1.171
Food preference	0.953	1.050
REB	0.903	1.107
EmEB	0.875	1.143
Health status	0.803	1.245
Sleep duration	0.938	1.067
Smoking status	0.907	1.103
Psychological distress	0.956	1.046
Social support	0.912	1.096
Physical activity level	0.934	1.070

Continuation of Table 12

Hosmer -Lemeshow Test	
Chi-square	p
12.954	0.113
Classification table	
Overall percentage	82.6

Note: p-level of statistical significance.

In multivariable logistic regression, gender, age, attitudes towards nutrition, food preference, REB, psychological distress, social support and physical activity level were significantly associated with overweight and obesity among NEFU students [73]. There was a significant association between overweight & obesity and gender of the students. Male students were 2.5 times more likely to be overweight and obese as compared to female students [AOR=2.498; 95% CI (1.297-4.811)]. Age of university students was also another factor associated with overweight and obesity among NEFU students. As age of students increases by one year, the probability of being overweight and obese increases by 1.3 times [AOR=1.257; 95% CI (1.075-1.471)]. Similarly, a significant association was seen between attitude towards nutrition and overweight and obesity among NEFU students. NEFU students who had positive attitudes towards nutrition were 53.9% less likely to be overweight and obese as compared to students who had negative attitudes towards nutrition [AOR=0.461; 95% CI (0.249-0.854)]. Food preference was also associated with overweight and obesity. Students who prefer to eat only purchased foods were 5.0 times more likely to be overweight and obese as compared to students who prefer to eat only home cooked foods [AOR=4.973 ; 95% CI (1.097-22.546)].

REB was also associated with overweight and obesity among NEFU students. NEFU students who had REB were 1.9 times more likely to be overweight and obese as compared students who didn't have REB [AOR=1.883; 95% CI (1.004-3.529)].Psychological distress was also another factor associated with overweight and obesity among NEFU students. NEFU students who had symptoms of depression and anxiety were 2.5 times more likely to be overweight and obese as compared to university students who didn't have symptoms of depression and anxiety (AOR=2.49; 95% CI (1.126-5. 511)]. A statistically significant association was also seen between social support and overweight and obesity among NEFU students. NEFU students who had

strong social support were 61.7% less likely to be overweight and obese as compared to students who had poor social support [AOR=0.383; 95% CI (0.148-0.989)]. Similarly, a statistically significant association was seen between physical activity level and overweight and obesity among NEFU students [73]. NEFU students who had moderate level of physical activity were 67.7% less likely to be overweight and obese as compared to students who had low level of physical activity [AOR=0.323; 95% CI (0.174-0.600)]. NEFU students who had high level of physical activity were 93.6% less likely to be overweight and obese as compared to students who had low level of physical activity [AOR=0.064; 95% CI (0.018-0.230)] (Table 13).

Table 13 – Multivariate logistic regression of factors associated with overweight and obesity among NEFU students

Variables		Frequency	Non overweight and obese (n=289)	Overweight and obese (n=95)	AOR (95% CI)	p
Gender	Female	242	193	49	1	-
	Male	142	96	46	2.498(1.297-4.811)	0.006
Age (in years)	Mean ± SD	20.93 ± 2.1	20.69± 2.04	21.66± 2.16	1.257(1.075-1.471)	0.004
Attitudes towards nutrition	Negative	178	125	53	1	-
	Positive	206	164	42	0.461(0.249-0.854)	0.014
Food preference	Only home cooked food	30	26	4	1	-
	Only purchased food	78	51	27	4.973(1.097-22.546)	0.038
	Both	276	212	64	2.722(0.670-11.062)	0.162
REB	No	216	177	39	1	-
	Yes	168	112	56	1.883(1.004-3.529)	0.049
Psychological distress	No	328	253	75	1	-
	Yes	56	36	20	2.491 (1.126-5.511)	0.024
Social support	Poor	49	31	18	1	-
	Moderate	162	122	40	0.663(0.258-1.704)	0.394
	Strong	173	136	37	0.383 (0.148-0.989)	0.047

Continuation of Table 13

Physical activity	Low	165	100	65	1	-
	Moderate	166	140	26	0.323(0.174-0.600)	<0.0001
	High	53	49	4	0.064(0.018-0.230)	<0.0001

Note: p-level of statistical significance, SD- standard deviation.

The following formula represents the equation for this logistic regression model:

$$P = \frac{1}{1+e^{-(-8.055+0.916X_1+0.229X_2-0.774X_3+1.604X_4+0.633X_5+0.913X_6-0.960X_7-1.131X_8-2.741X_9)}}$$

Where,

p – probability of overweight and obesity

e – base of natural logarithm (e= 2.72)

X_1= gender (Male)

X_2= Age

X_3 = Attitudes towards nutrition (Positive)

X_4 = Food preference (Only purchased food)

X_5= REB (Yes)

X_6= Psychological distress (Yes)

X_7=Social support (Strong)

X_8=Physical activity (Moderate)

X_9 =Physical activity (High)

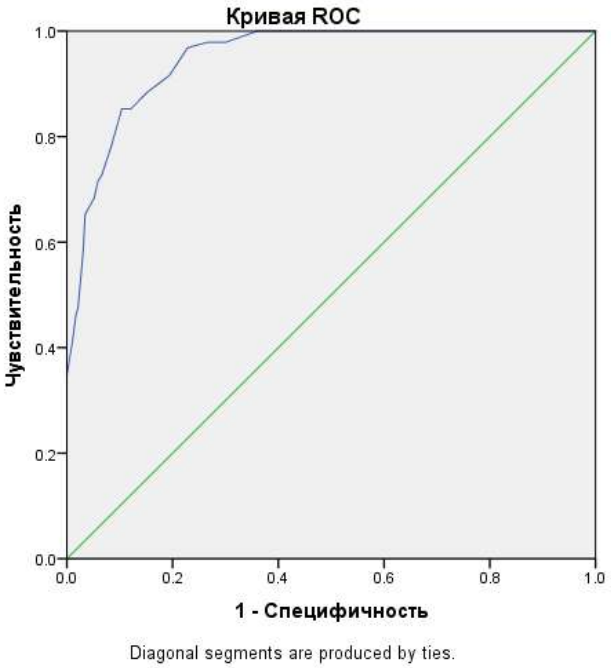


Figure 49 – ROC curve of a logistic regression model for predicting overweight and obesity among NEFU students

The model for predicting overweight and obesity had a sensitivity of 96.8% and a specificity of 77.2% (Figure 49).

Based on the ROC curve, the AUC value was 0.949 $\pm$0.010 (95% CI 0.928-0.969; $p < 0.001$), which corresponds to a high quality of the predictive model.

4.2 Medical and social factors affecting eating behavior of NEFU students

4.2.1 Characteristics of eating behavior among female and male university students

Independent sample t-tests comparing the mean scores of ExEB, EmEB, REB, social support, psychological distress BMI and age between female and male university students are presented in Table 14. The mean score of REB was higher among female students compared to male students. However, there was no statistically significant difference between the mean REB scores among female and male students ($p = 0.260$). The mean scores of EmEB and ExEB were higher among female students compared to male students. There was a statistically significant difference in the mean scores of ExEB

($p = 0.004$) and EmEB ($p < 0.001$) between female and male students. The mean BMI score was higher in male students compared to female students. There was a statistically significant difference between the mean BMI scores among female and male students ($p<0.001$). The mean psychological distress score was higher among female students compared to male students. There was a statistically significant difference between the mean psychological distress scores among female and male students ($p < 0.001$) [74].

Table 14 – Characteristics of eating behavior among female and male students

Variables	Male(n=142)	Female (n=242)	
	Mean ±SD	Mean ±SD	p
Age (in years)	20.86 ± 2.10	20.98 ± 2.11	0.603
ExEB	2.77 ± 0.66	3.09 ± 0.72	0.004
EmEB	2.10 ± 0.88	2.45 ± 0.96	<0.001
REB	2.18 ± 0.90	2.29 ± 0.86	0.260
BMI	23.69 ± 4.09	22.02 ± 3.72	<0.001
Social support	8.61 ± 2.81	8.91 ± 2.172	0.263
Psychological distress	1.00 ± 0.79	1.33 ± 0.79	<0.001

Note: p-level of statistical significance, SD- standard deviation.

4.2.2 Relationship between eating behavior, age and BMI

Pearson correlations between BMI, age, REB, ExEB and EmEB are presented in Table 15. ExEB was positively correlated with EmEB ($r = 0.567$; $p < 0.001$). Similarly, ExEB was positively correlated with REB ($r = 0.205$; $p < 0.001$). In addition, EmEB was positively correlated with REB ($r=0.329$; $p<0.001$). A positive correlation ($r=0.311$; $P<0.001$) was found between REB and BMI. BMI was positively correlated with age ($r = 0.230$; $p < 0.001$) [74]. However, eating behavior was not significantly correlated with age (Table 15).

Table 15 – Relationship between age, eating behavior and BMI

Variables	Age	ExEB	EmEB	REB	BMI
	r (p)	r (p)	r (p)	r (p)	r (p)
Age	1				
ExEB	-0.051 (0.319)	1			
EmEB	-0.045 (0.379)	0.567 (<0.001)	1		
REB	-0.018 (0.726)	0.205 (<0.001)	0.329 (<0.001)	1	
BMI	0.230(<0.001)	-0.026 (0.613)	0.019 (0.708)	0.311(<0.001)	1

Note: r-Pearson correlation coefficient, p-level of statistical significance.

4.2.3 Factors associated with restrictive eating behavior of NEFU students

To identify factors associated with REB, both bivariate and multi variable logistic regressions were performed. Variables with a significance level of p<0.25 in the bivariate analysis were chosen for potential inclusion in multivariate logistic regression. Variables with a significance level of p<0.25 in the bivariate logistic regression were institute of study, year of study, employment status of the father, opportunity to earn extra money, living in NEFU dormitory, BMI, attitudes towards nutrition, snack consumption, nutritional supplement , EmEB, ExEB and physical activity level.

Multicollinearity (VIF<3) and Hosmer-Lemeshow test (>0.05) were checked before proceeding multivariate analysis. Since VIF was less than 3, Hosmer –Lemeshow test was non-significant and classification table was greater than 50%, the multivariate logistic regression model is a good fit (Table 16).

Table 16 - Multicollinearity and Hosmer-Lemeshaw test for factors associated with REB of NEFU students

Dependent variable:REB		
Independent variable	Collinearity Statistics	
	Tolerance	VIF
Institute of study	0.856	1.168
Year of study	0.835	1.198
Employment status of the father	0.958	1.044
Opportunity to earn extra money	0.917	1.091
Living in NEFU dormitory	0.943	1.060
BMI	0.870	1.149
Attitudes towards nutrition	0.929	1.076
Snack consumption	0.960	1.041
Nutritional supplement	0.931	1.074
EmEB	0.787	1.270
ExEB	0.776	1.288
Physical activity level	0.886	1.129
Hosmer and Lemeshow Test		
Chi-square	p	
4.368	0.822	
Classification table		
Overall percentage	70.3	

Note: p- level of statistical significance.

In multivariable logistic regression, institute of study, year of study, BMI, EmEB, ExEB and physical activity level were significantly associated with REB of NEFU students [74] . There was a statistically significant association between REB and institute of NEFU students. NEFU students from the pedagogical institute were 2.7 times more likely to have REB as compared to students from the medical institute [AOR=2.699; 95% CI (1.193-6.104)]. Year of study of students was also significantly associated with REB. Second year students were 69.5% less likely to have REB as compared to first year students [(AOR=0.305; 95% CI (0.137-0.676)]. BMI was another factor which was significantly associated with REB. Overweight and obese students were 2.2 times more likely to have REB as compared to non-overweight and non-obese students [AOR =2.185; 95% CI (1.24-3.85)].

EmEB was also significantly associated with REB. Students with an EmEB were 1.8 times more likely to have REB as compared to students without EmEB [AOR=1.812; 95% CI (1.033-3.179)]. ExEB was another factor which was significantly associated with REB. Students with an ExEB were 3.1 times more likely to have REB as compared students without ExEB [AOR=3.143; 95% CI (1.75-5.642)].Physical activity level was also significantly associated with REB. NEFU Students who had a moderate physical activity were 47% less likely to have REB as compared to students who had a low physical activity [AOR=0.53;95% CI (0.316-0.89)] (Table 17).

Table 17 – Bivariate and multivariate logistic regression analysis of factors affecting REB among NEFU students

Variable		Total Number (%)	REB		COR (95% CI)	AOR (95% COR)
			No	Yes		
Institute of study	Medical Institute	211 (54.9)	122	89	1	1
	Institute of Physical Culture and Sports	70 (18.2)	34	36	1.451 (0.844-2.497)	1.79(0.93-3.445)
	Pedagogical Institute	57 (14.8)	26	31	1.634 (0.907-2.944)	2.699*(1.193-6.104)*
	Institute of mathematics and Informatics	24 (6.3)	19	5	0.361(0.13-1.003)	0.434(0.114-1.652)
	Institute of Natural Sciences	14 (3.7)	9	5	0.762(0.247-2.35)	1.028(0.255-4.15)
	Institute of Physics and Technology	8 (2.1)	6	2	0.457(0.09 - 2.317)	1.989 (0.313-12.653)

Continuation of Table 17

Year of study	First year	151 (39.3)	74	77	1	1
	Second year	56 (14.6)	38	18	0.455(0.239 - 0.868)	0.305(0.137-0.676)*
	Third year	65(16.9)	44	21	0.459(0.249-0.844)	0.554(0.228-1.344)
	Fourth year and above	112 (29.2)	60	52	0.833(0.51-1.359)	0.54 (0.275-1.058)
Employment status of father	Employed	212 (55.2)	123	89	1	1
	Unemployed	25 (6.5)	18	7	0.537 (0.215-1.341)	0.484(0.175-1.34)
	Pensioner	54 (14.1)	26	28	1.488 (0.817-2.71)	1.09(0.546-2.177)
	Don't know	93 (24.2)	49	44	1.241 (0.76-2.026)	1.072(0.613-1.875)
Opportunity to earn extra money	No	166 (43.2)	86	80	1	1
	Yes	218 (56.8)	130	88	0.728 (0.484-1.094)	0.748(0.461-1.211)
Living in NEFU dormitory	No	135 (35.2)	83	52	1	1
	Yes	249 (64.8)	133	116	1.392 (0.909-2.133)	1.002(0.605-1.661)
BMI	Non overweight and non-obese	289 (75.3)	177	112	1	1
	Overweight and obese	95 (24.7)	39	56	2.269 (1.415-3.639)	2.185(1.24-3.85)*
Attitudes towards nutrtion	Negative attitude	178 (46.4)	94	84	1	1
	Positive attitude	206 (53.6)	122	84	0.77(0.514-1.155)	0.776(0.483-1.246)
Snack consumption	No	8 (2,1)	7	1	1	1
	Yes	376 (97.9)	209	167	5.593(0.68145 .911)	5.496(0.456-66.3)
Nutritional supplement	No	148 (38.50)	89	59	1	1
	Yes	236 (61.50)	127	109	1.295(0.853-1.964)	1.362(0.832-2.228)
EmEB	No	125(32.60)	93	32	1	1
	Yes	259 (67.40)	123	136	3.213(2.009-5.141)	1.812(1.033-3.179)*
ExEB	No	119 (31.00)	90	29	1	1
	Yes	265 (69.00)	126	139	3.424(2.112-5.549)	3.143(1.75-5.642)**
Physical activity level	Low	165 (43.0)	81	84	1	1
	Moderate	166 (43.2)	106	60	0.546(0.352-0.847)	0.53(0.316-0.89)*
	High	53 (13.8)	29	24	0.798(0.429-1.485)	0.971(0.462-2.04)

Note: *p<0.05, **p<0.001.

The following formula represents the equation for this logistic regression model:

$$p = \frac{1}{1+e^{-(-2.751+0.993X_1-1.188X_2+0.782X_3+0.595X_4+1.145X_5-0.635X_6)}}$$

Where,

P=probability of REB (yes)

X1= Institute of study (pedagogical institute)

X2= Year of study (second year)

X3= BMI (overweight and obesity)

X4=EmEB (yes)

X5= ExEB (yes)

X6= Physical activity (moderate)

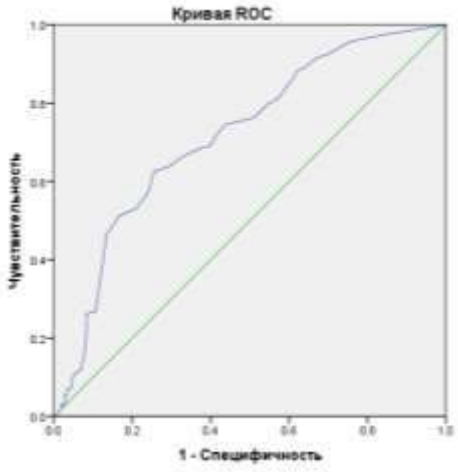


Figure 50 – ROC curve of the logistic regression model for predicting REB of NEFU students

The logistic regression model for predicting REB had a sensitivity of 88.1% and a specificity of 38.0% (Figure 50).

Based on the ROC curve, the AUC value was 0.718±0.026 (95% CI 0.666-0.769; $p<0.001$), which corresponds to the good quality of the prediction model.

4.2.4 Factors associated with emotional eating behavior of NEFU students

To identify factors associated with EmEB, both bivariate and multi variable logistic regressions were performed. Variables with a significance level of $p<0.25$ in the bivariate logistic regression were gender, opportunity to earn extra money, BMI, nutrition

knowledge, attitudes towards nutrition , nutrition practice , snack consumption, REB, ExEB, sleep duration, mean score of psychological distress and sitting time.

Multicollinearity (VIF<3) and Hosmer-Lemeshow test (>0.05) were checked before proceeding multivariate analysis. Since VIF was less than 3, Hosmer –Lemeshow test was non-significant and classification table was greater than 50%, the multivariate logistic regression model was a good fit (Table 18).

Table 18 – Multicollinearity and Hosmer Lemeshow tests for factors associated with EmEB of NEFU students

Dependent variable : EmEB		
Independent variable	Collinearity Statistics	
	Tolerance	VIF
Gender	0.902	1.109
Opportunity to earn extra money	0.954	1.048
BMI	0.907	1.103
Nutrition knowledge	0.97	1.031
Attitudes towards nutrition	0.929	1.077
Nutrition practice	0.904	1.106
Snack consumption	0.958	1.044
REB	0.888	1.126
ExEB	0.858	1.166
Sleep duration	0.917	1.09
Mean psychological distress	0.866	1.155
Sitting time	0.923	1.083
Hosmer and Lemeshow Test		
Chi-square	p	
4.548	0.805	
Classification table		
Overall percentage	67.4	

Note: p-level of statistical significance.

In multivariable logistic regression, gender, REB, ExEB and mean psychological distress score were significantly associated with EmEB [74] . There was a statistically significant association between EmEB and gender of students. Male students were 43.4% less likely to have EmEB as compared to female students [AOR=0.566; 95%CI (0.327-0.977)]. REB was also associated with EmEB. Students with REB were 2.1 times more likely to have EmEB as compared to students without REB. ExEB was another factor associated with EmEB. Students with an ExEB were 5.9 times more likely to have EmEB as compared to students without ExEB [AOR= 5.901; 95% CI (3.394-10.262)]. Mean psychological distress score was also associated with EmEB. As the mean score of

psychological distress increases, the probability of having EmEB increases by 2.1 times [AOR=2.134; 95% CI (1.503-3.031)] (Table 19).

Table 19 – Bivariate and multivariate logistic regression analysis of factors affecting EmEB of NEFU students

Variable		Frequency (%)	EmEB		COR (95%CI)	AOR (95%CI)
			No	Yes		
Gender	Female	242 (63)	65	177	1	1
	Male	142(37)	60	82	0.502 (0.324-0.778)*	0.566 (0.327- 0.977)*
Opportunity to earn extra money	No	166 (43.2)	45	121	1	1
	Yes	218 (56.8)	80	138	0.642 (0.413-0.995)	0.729 (0.426-1.249)
BMI	Non overweight and non-obese	289 (75.3)	99	190	1	1
	Overweight and obese	95 (24.7)	26	69	1.383 (0.828-2.308)	1.596 (0.832-3.064)
Nutrition knowledge	Poor knowledge	192 (50.0)	57	135	1	1
	Good knowledge	192 (50.0)	68	124	0.77 (0.502-1.181)	0.618 (0.364-1.047)
Attitudes towards nutrition	Negative attitude	178 (46.40)	52	126	1	1
	Positive attitude	206 (53.60)	73	133	0.752 (0.489-1.157)	0.929 (0.543 -1.591)
Nutrition practice	Bad practice	162 (42.20)	42	120	1	1
	Good practice	222 (57.80)	83	139	0.586 (0.376-0.914)	1.01 (0.583-1.75)
Snack consumption	No	8 (2.10)	6	2	1	1
	Yes	376 (97.90)	119	257	6.479 (1.289-32.575)*	4.001 (0.661 -24.206)
REB	No	216(56.30)	93	123	1	1
	Yes	168 (43.80)	32	136	3.213 (2.009-5.141)**	2.077 (1.204-3.585)*
ExEB	No	119 (31.0)	75	44	1	1
	Yes	265(69.0)	50	215	7.33 (4.522-11.88)**	5.901 (3.394-10.262)**
Sleep duration	<7hours	139 (36.20)	38	101	1	1
	7-8Hours	210 (54.70)	72	138	0.721 (0.451-1.153)	1.24 (0.691 -2.224)
	9 hours and above	35 (9.10)	15	20	0.502 (0.233-1.08)	0.979 (0.381-2.517)

Continuation of Table 19

Mean Psychological distress	Mean ±SD	2.21 ± 0.81	1.88 ±0.79	2.37±0.77	2.285 (1.697-3.077)**	2.134 (1.503-3.031)**
Sitting time	<3hrs/day	91 (23.70)	41	50	1	1
	4-6hrs/day	132 (34.40)	46	86	1.533 (0.888-2.648)	1.507 (0.771-2.945)
	>6 hrs/day	161 4(1.90)	38	123	2.654 (1.531-4.602)	1.844 (0.943-3.605)

Note: SD- Standard Deviation, *p<0.05, **p<0.001.

The following formula represents the equation for this logistic regression model:

$$p = \frac{1}{1+e^{-(-3.575-0.570X_1+0.731X_2+1.775X_3+0.758X_4)}}$$

Where,

p – probability of EmEB (yes)

e – base of natural logarithm (e= 2.72)

X1= Gender (male)

X2= REB (yes)

X3= ExEB (yes)

X4 = Mean psychological distress

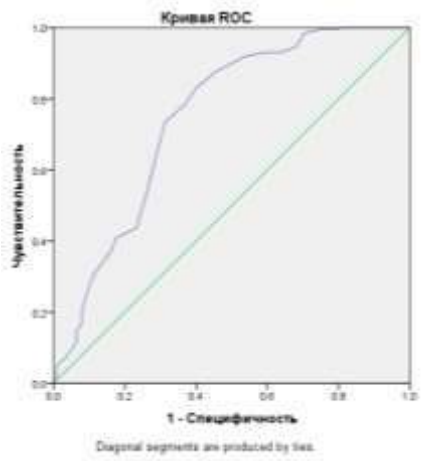


Figure 51 – ROC curve of the logistic regression model for predicting the EmEB of NEFU students

The model for predicting EmEB had a sensitivity of 83% and a specificity of 60% (Figure 51).

Based on the ROC curve, the AUC value was 0.748 ± 0.029 (95% CI 0.692-0.805; $p < 0.001$), which corresponds to the good quality of the predictive model.

4.2.5 Factors associated with external eating behavior of NEFU students

To identify factors associated with ExEB, both bivariate and multi variable logistic regressions were performed. Variables with a significance level of $p<0.25$ in the bivariate analysis were chosen for potential inclusion in multivariable logistic regression. Variables with a significance level of $p<0.25$ in the bivariate logistic regression were age, living in NEFU dormitory, satisfaction with NEFU services, attitudes towards nutrition, nutrition practice, snack consumption, REB, EmEB, sleep duration and sitting time.

Multicollinearity (VIF<3) and Hosmer-Lemeshow test (>0.05) were checked before proceeding multivariate analysis. Since VIF was less than 3, Hosmer –Lemeshow test was non-significant and classification table was greater than 50%, the multivariate logistic regression model is a good fit (Table 20).

Table 20 – Multicollinearity and Hosmer Lemeshow tests for factors associated with ExEB of NEFU students

Dependent variable : ExEB		
Independent variable	Collinearity Statistics	
	Tolerance	VIF
Age	0.978	1.023
Living in NEFU dormitory	0.901	1.109
Satisfaction with NEFU services	0.961	1.041
Attitudes toward nutrition	0.956	1.047
Nutrition practice	0.891	1.122
Snack consumption	0.955	1.048
REB	0.924	1.083
EmEB	0.875	1.143
Sleep duration	0.977	1.024
Sitting time	0.928	1.077
Hosmer and Lemeshow Test		
Chi-square	p	
3.762	0.878	
Classification Table		
Overall Percentage	75.5	

Note: p-level of statistical significance.

In multivariate logistic regression, satisfaction with NEFU services, REB, EmEB and sleep duration were significantly associated with ExEB [74] . There was a statistically

significant association between satisfaction of students with NEFU services and ExEB. Students who were satisfied with NEFU services were 59.9% less likely to have ExEB as compared to students who were not satisfied with NEFU services [AOR=0.401; 95% CI (0.167-0.961)]. REB was also associated with ExEB. Students with REB were 2.5 times more likely to have ExEB as compared to students without REB [AOR=2.466; 95% CI (1.434-4.241)]. EmEB was another factor associated with ExEB. Students with EmEB were 5.3 times more likely to have ExEB as compared to students without EmEB [AOR= 5.354; 95% CI (3.184-9.003)]. Sleep duration was also significantly associated with ExEB. Students who slept 9 hours per day and above were 61.2% less likely to have ExEB as compared to students who slept less than 7 hours per day [AOR= 0.388; 95% CI (0.156-0.967)] (Table 21).

Table 21 – Bivariate and multivariate logistic regression analysis of factors affecting the ExEB of NEFU students

Variable		Frequency (%)	ExEB		COR (95% CI)	AOR (95% CI)
			No	Yes		
Age	Mean ±SD	20.93 ± 2.1	21.13 ± 2.147	20.84 ± 2.087	0.936 (0.845-1.037)	0.959 (0.848-1.084)
Living in NEFU dormitory	No	135(35.20)	51	84	1	1
	Yes	249 (64.80)	68	181	1.616 (1.035-2.524)	1.385 (0.803-2.386)
Satisfied with NEFU services	No	54(14.10)	9	45	1	1
	Yes	330 (85.90)	110	220	0.4 (0.189 -0.848)*	0.401 (0.167-0.961)*
Attitudes towards nutrition	Negative	178(46.40)	48	130	1	1
	Positive a	206 (53.60)	71	135	0.702 (0.453-1.088)	0.779 (0.461-1.316)
Nutrition practice	Bad	162(42.20)	37	125	1	1
	Good	222 (57.80)	82	140	0.505 (0.32-0.798)	0.61 (0.353-1.057)
Snack consumption	No	8 (2.10)	5	3	1	1
	Yes	376 (97.90)	114	262	3.83 (0.9-16.299)	2.127 (0.382-11.833)
REB	No	216(56.30)	90	126	1	1
	Yes	168(43.80)	29	139	3.424(2.112-5.549)**	2.466 (1.434-4.241)*
EmEB	No	125(32.60)	75	50	1	1
	Yes	259 (67.40)	44	215	7.33 (4.522-11.88)**	5.354 (3.184-9.003)**

Continuation of Table 21

Sleep duration	<7hours	139 (36.20)	33	106	1	1
	7-8Hours	210 (54.70)	69	141	0.636 (0.392-1.034)	0.757(0.432-1.326)
	9 hours and above	35 (9.10)	17	18	0.33 (0.153-0.712)*	0.388 (0.156-0.967)*
Sitting time	<3hrs/day	91(23.70)	36	55	1	1
	4-6hrs/day	132 (34.40)	48	84	1.145 (0.661 -1.985)	0.92 (0.476-1.777
	>6 hrs/day	161 (41.90)	35	126	2.356 (1.342-4.137)	1.628 (0.835-3.177)

Note: *p<0.05, **p<0.001, SD- standard deviation.

The following formula represents the equation for this logistic regression model:

$$p = \frac{1}{1+e^{-(0.727-0.915X_1+0.903X_2+1.678X_3-0.947X_4)}}$$

Where,

p – probability of ExEB (yes)

e – base of natural logarithm (e= 2.72)

X_1= Satisfaction with NEFU services (yes)

X_2 = REB (yes)

X_3= EmEB (yes)

X_4= sleep duration (9 hours per day and above)

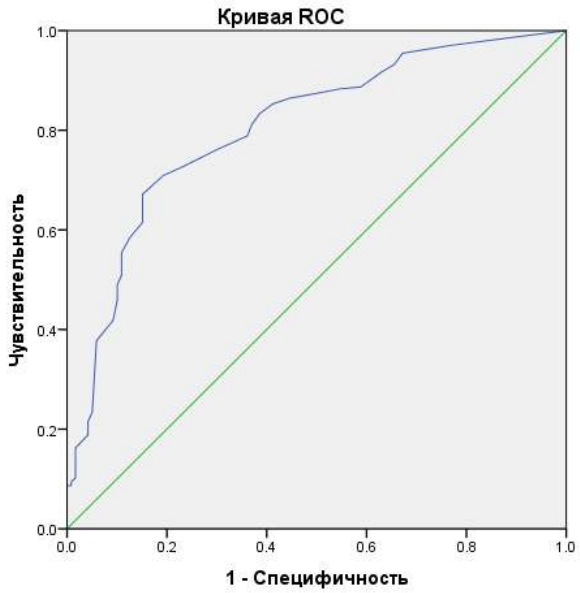


Figure 52 – ROC curve of the logistic regression model for predicting ExEB of NEFU students

The model for predicting ExEB had a sensitivity of 83.4% and a specificity of 61.3% (Figure 52).

Based on the ROC curve, the AUC value was 0.805 $\pm$ 0.024 (95% CI 0.758-0.852; $p<0.001$), which corresponds to the high quality of the predictive model.

According to the survey results, gender, age, attitudes towards nutrition, food preferences, restrictive eating behavior, psychological stress, social support and level of physical activity were significantly associated with overweight and obesity among college youth. Positive correlations were found between three different types of eating behavior, namely externalizing eating behavior, restrictive eating behavior and emotional eating behavior. This indicates the need to develop organizational measures to prevent overweight and obesity among university students based on identified medical and social risk factors.

CHAPTER 5. DEVELOPMENT OF PREVENTIVE MEASURES TO REDUCE OVERWEIGHT AND OBESITY AMONG NEFU STUDENTS

We have identified the main medical and social risk factors affecting overweight and obesity among NEFU students. The factors affecting overweight and obesity can be categorized into four groups: unhealthy eating behavior, low physical activity, psychological distress and poor social support. Therefore, attention should be taken to address these risk factors.

The development of measures for the prevention of overweight and obesity among university students depends on the creation of organizational and pedagogical conditions in the educational institution that help in solving the problem that has arisen. The main preventive measures to reduce overweight and obesity among NEFU students include promoting healthy eating, promoting physical activity, organizing a school for the formation of mental health, and developing a social support system for students.

Based on the research results, we have developed a set of preventive measures to reduce overweight and obesity among NEFU students in the following areas:

– Medical measures

– Awareness-raising measures

– Sports and recreational measures

– Research measures

Medical measures

– Development and implementation of an integrated system for monitoring and evaluation of risk factors for overweight and obesity;

– Conducting regular screening tests (medical checkups) for early detection and identification of overweight and obesity;

– Referring students to specialized medical care institutions for further diagnostic testing if they are identified as having the risk factors for overweight and obesity during screening activities.

Awareness-raising measures

– Information and communication campaigns to promote healthy eating among students;

– Strengthening the training of nutrition and health specialists to promote healthy eating;

– Creation of banners, booklets, posters and stands promoting healthy eating and lifestyle;

– Creation of nutrition friendly initiatives to make healthy foods available and affordable in the university. This can be achieved through collaboration between NEFU and the food industry (NEFU partner organizations);

– Implementation of quality standards for meals (breakfast and lunch) in the university cafeteria;

– Organization of a school for the formation of mental health. This is important for providing students with knowledge about depression and anxiety and their management mechanisms.

– Introducing the work of supervisors to identify early signs of stress and depression through social surveys or conversations with students.

– Development of a social support system consisting of students, friends, peers and expert consultants. These networks can provide advice, information, as well as practical and emotional support to students in order to help them prevent stress and obesity.

Sports and recreational measures

– Organization of physical education and health or sports programs focused on extracurricular activities (for example, sports festivals, competitions, competitions, tournaments, holidays) to increase the attractiveness of sports and a healthy lifestyle;

– Development of more recreational facilities such as gyms and sports centers at the university;

– Ensuring accessibility of sports and physical education for all students;

– Strengthening both material and non-material incentives for students who actively promote a healthy lifestyle, participate in volunteer groups and winners of sports competitions;

– Introduction of modern health technologies into the process of physical education.

Research measures

– Development of scientific foundations for promoting healthy eating and physical activity among university students;

– Conduct regular surveys similar to those conducted in this study, as well as further longitudinal studies, to better understand the relationship between overweight/obesity and its causative factors.

The scheme of interdepartmental interaction on the prevention of overweight and obesity among university students is presented in Figure 53.

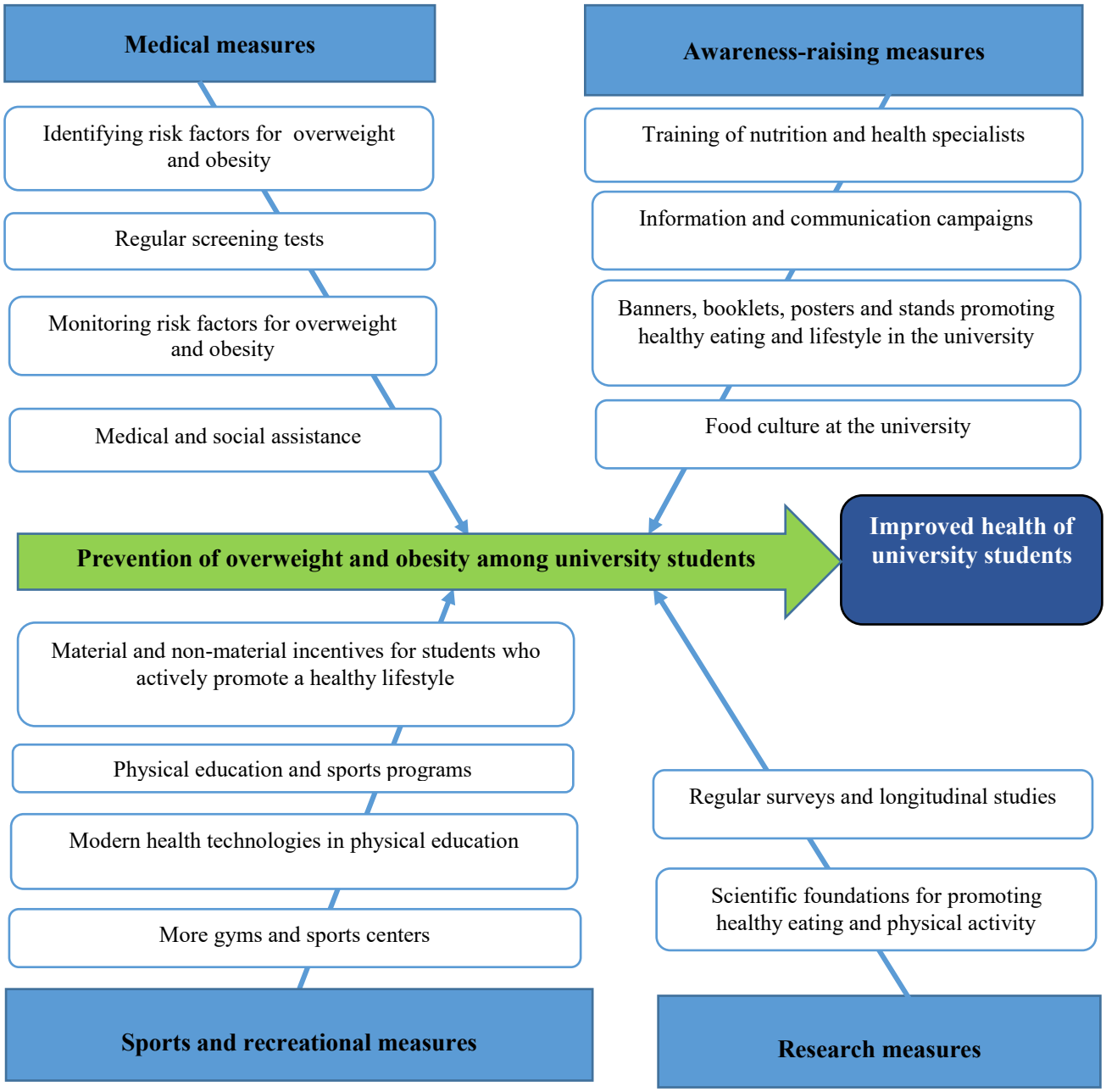


Figure 53 – Scheme of interdepartmental interaction on the prevention of overweight and obesity among university students

CONCLUSION

The primary incidence of non-communicable diseases related to nutrition among the entire population of the Russian Federation and the Republic of Sakha (Yakutia) (per 1000 population), had an increasing trend. For example, the primary incidence of diseases of the circulatory system among the entire population of the Republic of Sakha (Yakutia) (per 1000 population) in 2020 and 2022 were 18.9 and 24.5, respectively. On the other hand, according to the NEFU clinic, the frequency (pathological incidence) of these diseases among NEFU students (per 1000 examined students), had a fluctuating trend.

In this study, the combined prevalence of overweight and obesity among NEFU students was 24.7%. This result is similar to other studies conducted in Bosnia and Herzegovina (24.8%) [221]; Tajikistan (25.3%) [86]; Cameroon (24.7%) [162] and Ghana (25.9%) [228]. However, the combined prevalence of overweight and obesity in this study is lower than in other studies conducted in Brazil (34.2%) [164]; Slovakia (40.9%) [169]; Saudi Arabia (35.3%) [253]; Malaysia (34.9%) [241]; India (37.5%) [231]; Peru (32.3%) [148]; Botswana (36.8%) [240]; Egypt (40.7%) [221]; Yemen (34.2%) [123] and Pakistan (33.1%) [246].This discrepancy may be due to differences in socioeconomic characteristics, study population, sample size, sampling methods, and culture. In contrast, the combined prevalence of overweight and obesity in this study is higher than in other studies conducted in Greece (17.2%) [203]; Türkiye (17.3%) [244]; India (11.66%) [238]; Pakistan (13.9%) [190]; Iran (15.5%) [214]; Japan (7.2%) [225]; China (10.6%) [157]; Yaroslavl, RF (12.66%) [7]; Samara and Kemerovo, RF (16.2%) [93] and Altai, RF (12.5%) [81].This discrepancy may be due to differences in sample size, study population, and geopolitical factors.

In this study, gender, age, attitudes towards nutrition, food preferences, REB, psychological stress, social support and physical activity were significantly associated with overweight and obesity among NEFU students. Male students were 2.5 times more likely to be overweight and obese compared to female students. Studies conducted in Peru [148], Botswana [240], Bosnia and Herzegovina [221], Greece [203], Yemen [123], Japan [225], RF [53] and Malaysia [234] showed that male university students are more likely

to be overweight and obese compared to female university students. However, studies in Cameroon [162], Morocco [138], Slovakia [169] and India [238] have shown that the likelihood of being overweight and obese is higher among female students compared to male students. The difference in the prevalence of overweight and obesity among male and female students in this study may be due to differences in nutrition knowledge, eating habits, and social support among men and women. In this study, male students had lower levels of nutrition knowledge compared to female students. Similarly, a higher percentage of male students (28.9%) prefer to eat food prepared outside the home compared to female students (15.3%). Additionally, a higher percentage of male students (16.2%) had poor social support compared to female students (10.7%).

The age of NEFU students was also another factor associated with overweight and obesity. In this study, as students' age increased by one year, the odds of being overweight and obese increased by 1.3 times. Similar findings from Botswana [240] and Yemen [123] also showed that the prevalence of overweight and obesity increased with age. In the current study, this discrepancy may be due to differences in food preferences and social support among older and younger university students. In this study, older university students preferred to eat foods prepared outside the home and had poor social support.

A statistically significant association was also observed between attitudes towards nutrition and overweight/obesity among NEFU students. In the current study, NEFU students who had positive attitudes toward nutrition were 53.9% less likely to be overweight and obese compared to students who had negative attitudes toward nutrition. Similar findings from Iran [214] and Kuwait [215] also showed that higher nutritional attitude scores were associated with lower BMI. In this study, only 12.2% of NEFU students strongly agreed that they eat enough fruits and vegetables to control their weight and stay healthy. Additionally, only 21.1% of NEFU students strongly agreed that they were confident in eating fruits/vegetables instead of cake, cookies, candy, ice cream or other sweets for dessert.

Food preferences have also been linked to overweight and obesity. Students who choose to eat only purchased foods are 5.0 times more likely to be overweight and obese compared to students who choose to eat only home-cooked foods. Similar results from

the USA [259], Japan [254] and China [192,263] also showed that people who ate purchased foods had higher odds of being overweight and obese compared to people who preferred to eat only home-cooked foods. Previous studies have shown that home-prepared foods may contain less sugar, salt, and saturated fat than purchased food (ready-to-eat foods) [129, 217].

A statistically significant association was also found between REB and overweight/obesity among NEFU students. In this study, university students who with REB were 1.9 times more likely to be overweight and obese compared to students who did not have REB. Similar findings from Japan [225] and Ukraine [196] also showed that REB was positively correlated with BMI. Previous studies have shown that REB may lead to increased hunger and appetite, leading to vulnerability to EmEB, overeating and ultimately leading to weight gain [209, 261, 262].

Psychological distress was also another factor associated with overweight and obesity among NEFU students. University students who had symptoms of depression and anxiety were 2,5 times more likely to be overweight and obese compared to university students who did not have symptoms of depression and anxiety. Similar findings from Brazil [222], USA [121] and China [149] showed that higher levels of depression and anxiety were associated with an increased risk of overweight and obesity. Previous research has shown that anxiety and depression can interfere with eating, sleep, physical activity and stress hormone levels. People with anxiety disorders often overeat to find comfort in food. Anxiety also tends to cause sleep disturbances, and the fatigue that results from poor sleep leads to decreased physical activity and overeating. In addition, anxiety disorders may cause excess production of cortisol, which alters the balance between hunger and satiety hormones [224, 260].

A statistically significant association was also found between social support and overweight/obesity among NEFU students. NEFU students who had strong social support were 61.7% less likely to be overweight and obese compared to students who had poor social support. Similar results from the USA [276], India [231] and Taiwan [163] showed that higher levels of social support were associated with a reduced risk of overweight and obesity. According to previous research, it is important to have friends or relatives who

encourage healthy eating and regular exercise to maintain a healthy weight [276]. In addition, social support may suppress symptoms of depression and anxiety [194].

Physical activity was also another factor associated with overweight and obesity among NEFU students. NEFU students who had moderate to high levels of physical activity were 67.7% and 93.6% less likely to be overweight and obese compared to students who had low levels of physical activity. , respectively. Similar results from Yemen [123], China [159] and RF [78,109] showed that increased physical activity reduced BMI and vice versa. Physical activity has been shown to increase total energy expenditure, which is important for maintaining energy balance or weight loss [188]. Physical activity can also reduce depression and anxiety [145,177].

Depending on the prevalence of eating behaviors, this study showed that 69% of NEFU students had ExEB. This finding is consistent with the study by Terekhova et al. [103]. Similarly, 67% of NEFU students had EmEB. This finding is higher than previous studies [49, 103,223]. In addition, this study found that 43.8% of NEFU students had REB. Compared to the studies by Caraterzi and Klimkovich [49], this prevalence is higher, but lower than the studies by Norazman et al. [223] and Terekhova et al. [103]. This discrepancy in the prevalence of eating behaviors among studies might be due to differences in sample size and study population.

In this study, institute of study, year of study, BMI, EmEB, ExEB and physical activity were significantly associated with REB. There was a statistically significant association between institute of study and REB of NEFU students. Students from the pedagogical institute were 2.7 times more likely to have REB as compared to students from the medical institute. The difference might be due to differences in nutrition knowledge, attitudes towards nutrition , nutrition practice and physical activity between medical and pedagogical students. In this study, medical students had higher levels of nutrition knowledge, attitudes towards nutrition, nutrition practice, physical activity as compared to pedagogical students.

Year of study of students was also another factor significantly associated with REB. Second year students were 69.5% less likely to have REB as compared to first year students. The difference might be due to differences in psychological distress and physical

activity. In this study, second year students had low prevalence of psychological distress (10.7%) compared to first year students (15.9%). Similarly, the prevalence of high level of physical activity among second year students (17.9%) was higher than first year students (11.9%).

A statistically significant association was also found between BMI and REB. Overweight and obese NEFU students were 2.2 times more likely to have REB as compared to non-overweight and non-obese students. This finding is similar to the study by Kowalkowska and Poínhos [201]. This might be due to the fact that REB can be both a cause and a consequence of overweight and obesity [180,262].

EmEB was also another factor significantly associated with REB. Students with an EmEB were 1.8 times more likely to have REB as compared to students without EmEB. This finding is similar to the study by Kowalkowska and Poínhos [201]. This might be due to the fact that EmEB is associated with weight gain. Weight gain in turn can lead to REB [180, 261,262].

A statistically significant association was also found between ExEB and REB. Students with an ExEB were 3.1 times more likely to have REB as compared students without ExEB. This finding is consistent to the study by Poínhos et al [235]. This might be due to the fact that ExEB is associated with weight gain. Weight gain in turn can lead to REB [209,261].

Physical activity was also significantly associated with REB. In this study, students who had a moderate level of physical activity were 47% less likely to have REB as compared to students who had a low level of physical activity. This might be due to the fact that physical activity can influence physiological and psychological processes such as appetite control, self-efficacy and body image, leading to greater self-determined motivation and, improvements in dietary self-regulation [130,147,208].

In this study, gender, REB, ExEB and mean score of psychological distress were significantly associated with EmEB. There was a statistically significant association between EmEB and gender of students. Male students were 43.4% less likely to have EmEB as compared to female students. This finding is similar to the study by Carlos et al [146], Yönder and Karakaş [275], Liu et al [206] and He et al [181]. This might be due

to the fact that females are more likely to eat in response to emotional states such as anxiety or depression. The anxiety or depression in turn can lead to EmEB [248].

REB was also associated with EmEB. Students with REB were 2.1 times more likely to have EmEB as compared to students without REB. This finding is similar to the study by Kowalkowska and Poínhos [201]. This might be due to the fact that REB can be both a cause and a consequence of EmEB [180,261, 261].

ExEB was another factor associated with EmEB. Students with an ExEB were 5.9 times more likely to have EmEB as compared to students without ExEB. This finding is similar to the study by Kalkan et al [193]. According to previous study, this might be due to the fact that ExEB occurs especially in cases of stress and the stress can also be associated with EmEB [182].

A statistically significant association was also found between mean psychological distress and EmEB. As the mean score of psychological distress increases, the probability of having EmEB increases by 2.1 times. This finding is similar to the study by Kalkan et al [193]. This can be explained by the fact that many people respond to stress by increasing their food intake because food is often a comfort in stressful situations [165].

In this study, satisfaction with NEFU services, REB, EmEB and sleep duration were significantly associated with ExEB. There was a statistically significant association between satisfaction of students with NEFU services and ExEB. Students who were satisfied with NEFU services were 59.9% less likely to have ExEB as compared to students who were not satisfied with NEFU services. This finding is similar to the study done by Konttinen et al [200].This can be explained by the fact that low levels of satisfaction are related to high levels of stress or depression and the stress or depression in turn can also be associated with ExEB [207].

REB was also associated with ExEB. Students with REB were 2.5 times more likely to have ExEB as compared to students without REB. This finding is consistent to the study by Poínhos et al [235]. This might be due to the fact that limiting food consumption for a longer period can induce hunger. The hunger in turn may lead to ExEB [209, 261,262].

EmEB was another factor associated with ExEB. Students with EmEB were 5.3 times more likely to have ExEB as compared to students without EmEB. This finding is similar to the study by Kalkan et al [193]. This might be due to the fact that EmEB can be both a cause and a consequence of ExEB [182].

Sleep duration was also significantly associated with ExEB. Students who slept 9 hours per day and above were 61.2% less likely to have ExEB as compared to students who slept less than 7 hours per day. This might be due to the fact that insufficient sleep is associated with adverse changes, such as symptoms of depression and anxiety [136] and the stress or depression in turn can also be associated with ExEB [200]. Insufficient sleep can also change appetite-regulating hormones and increases food intake [141,160, 179].

The current study has both strengths and limitations. The main primary strength of this study was the use of pretested questionnaire with a good reliability and higher response rate. In addition, this study assessed a wide range of factors which affect overweight and obesity. For example, nutrition knowledge, attitudes towards nutrition, EmEB, dietary intake, level of stress and social support, physical activity and sedentary behavior.

However, this study had certain limitations. First, the data for this study was collected through an online survey. Online survey was chosen for data collection because, according to research, it is important for obtaining a larger sample size, saving time, minimizing costs, and reducing social desirability bias. Studies have also shown that the results obtained from the online survey and traditional paper surveys were similar [85,131,135]. However, the degree of bias in online surveys cannot be determined since there is no way to determine the motives of those who responded [126,131,212].Second, this study used self-reported weight and height. However, several studies have shown that the results obtained from self-reported and measured weights and heights are valid and comparable [183,210,245,250]. Third, because data were collected from only one federal university, results are not generalizable to all Russian university students. Fourth, the self-reported items used in this study to assess the subscales of eating behaviors and psychological distress can only be used to identify symptoms and cannot be used to make

a diagnosis. In addition, recall bias may be an issue, especially for FFQ. To alleviate this problem this study used a shortened recall period of one week for the FFQ because longer recall periods increase recall bias [151,155,173,174,227,236,239,257,264,265]. Finally, due to the cross-sectional nature of this study, direct cause and effect relationship cannot be established between associated risk factors and overweight and obesity. Therefore, a properly designed longitudinal study will be necessary in future studies.

CONCLUSIONS

1. According to the data of Rosstat and the Ministry of Health of the Republic of Sakha (Yakutia) (for 2020-2022), the primary incidence of non-communicable diseases related to nutrition among the total population of the Russian Federation and the Republic of Sakha (Yakutia) (per 1,000 population), had an increasing trend. For example, the primary incidence of diseases of circulatory system among the entire population of the Republic of Sakha (Yakutia) (per 1,000 population) in 2020 and 2022 amounted to 18.9 and 24.5, respectively. On the other hand, according to the data of the NEFU clinic, the frequency (pathological incidence) of these diseases among NEFU students (per 1,000 examined students), had a fluctuating trend.

2. Gender, age, attitudes towards nutrition, food preferences, restrictive eating behaviors, psychological stress, social support, and physical activity level were significantly associated with overweight and obesity among student youth. For example, NEFU students with high levels of physical activity were 93.6% less likely to be overweight and obese compared to university students with low levels of physical activity.

3. Positive correlations were found between three different types of eating behaviors namely external eating behavior, restrictive eating behavior and emotional eating behavior. Institute of study, year of study, body mass index, emotional eating behavior, external eating behavior and physical activity of NEFU students were significantly associated with restrictive eating behavior. Gender, restrictive eating behavior, external eating behavior and mean psychological stress score of NEFU students were significantly associated with emotional eating behavior. Satisfaction with NEFU services, restrictive eating behavior, emotional eating behavior and sleep duration of NEFU students were significantly associated with externalizing eating behavior.

4. To reduce overweight and obesity among NEFU students, organizational preventive measures have been developed, such as promoting healthy eating, promoting physical activity, organizing a school for the formation of mental health and developing a social support system for students.

PRACTICAL RECOMMENDATIONS

At university level it is recommended to:

1. Create information and communication campaigns to promote healthy eating and physical activity, as well as develop a program to support psychological health and a social support system for students;
2. Expand the range of measures to promote a healthy lifestyle among students;
3. When planning measures to prevent obesity, take into account the characteristics of indicators of nutrition-related diseases in the region;
4. Increase the availability and quality of psychological assistance for students;
5. Introduce university educational programs on the basics of mental health;
6. To better understand the relationship between overweight/obesity and its causal factors, appropriately designed longitudinal studies will be needed in future studies.

At the federal level, it is recommended to:

1. Strengthen the work on the formation of healthy behavior among student youth;
2. Consider the issue of limiting the marketing and advertising of unhealthy foods (foods high in fat, sugar and salt) at the legislative level;
3. Consider introducing a tax on unhealthy foods (foods high in fat, sugar and salt).

LIST OF ABBREVIATIONS AND SYMBOLS

CI — Confidence Interval

IQR —Interquartile Range

BMI — Body Mass Index

NCD — Non-Communicable Diseases

REB — Restrictive Eating Behavior

SRS — Simple Random Sampling

RS (Y) — Republic of Sakha (Yakutia)

RF — Russian Federation

NEFU — North Eastern Federal University

T2DM — Type 2 Diabetes Mellitus

AOR— Adjusted Odds ratio

CVD — Cardiovascular Diseases

USA — United States of America

ExEB — External Eating Behavior

EmEB — Emotional Eating Behavior

AUC — Area Under the Curve

COR — Crude Odds Ratio

DEBQ — Dutch Eating Behavior Questionnaire

FAB — Food Attitudes and Behaviors

FFQ — Food Frequency Questionnaire

HSCL-10 — Hopkins Symptom Checklist-10

IPAQ — International Physical Activity Questionnaire

MET — Metabolic Equivalent of Task

OSS-3 — Oslo Social Support Scale-3

ROC — Receiver operating characteristic

SPSS — Statistical Package for Social Sciences

VIF — Variance Inflation Factor

LIST OF TERMS AND DEFINITIONS

Cronbach's alpha (Cronbach's α) is a reliability coefficient and a measure of the internal consistency of tests and measures.

Healthy nutrition is nutrition that ensures the growth, normal development and vital activity of a person, contributing to the strengthening of his health and the prevention of diseases.

Overweight and obesity are defined as abnormal or excessive accumulation of fat in the body, which can impair health.

Body mass index is defined as body weight in kilograms (kg) divided by the square of body height in meters (m^2), and expressed in units of kg/m^2.

Non-communicable disease also known as chronic disease, is typically long-term and results from a combination of genetic, physiological, environmental and behavioral factors.

Eating behavior is a complex interaction of physiological, genetic, psychological and social factors that can influence food preferences, meal timing and the amount of food consumed.

Cardiovascular diseases are a group of diseases of the heart and blood vessels, including coronary heart disease, stroke, congestive heart failure and other conditions.

Social support is the interaction with family members, peers, friends and professionals who share information and provide practical or emotional help.

Risk factors are factors of the external and internal environment of the body, behavioral factors that contribute to an increase in the likelihood of developing diseases, their progression and adverse outcome.

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APPENDICES

Appendix A. Information for study participants and consent form

Information for study participants

Dear Colleagues!

As part of the study "Medical and social factors affecting overweight, obesity and eating behavior of student youth and development of measures for their prevention", a survey of students of the NEFU is being conducted.

Purpose of the study

The study will be helpful to assess medical and social factors affecting overweight, obesity and eating behavior of university students at NEFU. The results of this study will be used by policy makers and other concerned bodies to design appropriate strategies to prevent overweight and obesity.

Procedure and duration

First of all you have been included in this study randomly. Providing as with relevant data is helpful for the study. There are questions about socio demographic and economic characteristics, weight and height, nutrition knowledge, attitudes towards nutrition, dietary intake, eating behavior, health status and life style characteristics. The survey will take 25 to 30 minutes to complete.

Risks

The risk of being participating in this study is very minimal, only taking few minutes for completing the survey.

Benefits

By this time you will not get any direct benefit for being participating in this study but the information you provide is essential to solve problems related to overweight, obesity and eating behavior among university students.

Confidentiality

The survey is anonymous. The finding of this study will be general for all study participants and will not reflect any thing particular to individual person.

Participation

Participation in this study is fully voluntary. You have the right to declare not to participate in this study. If you decide to participate first, you have the right to with draw from participating at any time.

To participate in this survey,

- You must be at least 18 years old.
- You must be NEFU undergraduate student.
- You must not be seriously ill.
- You must not be pregnant (for women).

Ethical approval

The research was approved by the local ethical committees of the medical institute of North Eastern Federal University.

Thank You.

Principal investigator: Mengist Getnet Abebe

Consent Form

I have understood and fully agreed to voluntarily take part and cooperate with the researcher after explaining to me the nature and purpose of the research.

I have understood that all information obtained from me will be in strict confidence, although information gained during the study may be published.

I was informed that I have the right to withdraw from the study at any time.

Study participant's signature_____

Date _____

(day, month, year)

Appendix B. Questionnaire

Questionnaire set to collect information on “Medical and social factors affecting overweight, obesity and eating behavior of student youth and development of measures for their prevention”.

To fill out the questionnaire, you must tick the option that corresponds to your opinion or write your answer in the free fields.

Block 1. Socio demographic and economic characteristics

Please read each statement and choose or complete the one most appropriate to you.

1. Your gender:

1) Female 2) Male

2. Your age (write):_____

3. Your country of origin (write):_____

4. Your ethnic background (write):_____

5. Your religion:

1) Orthodox Christian 3) Atheist

2) Muslim 4) Other (write):___

6. Your marital status:

1) Married 2) Unmarried

7. Institute or faculty which you study (write):_____

8. Year, you are studying in:

1) First year 3) Third year

2) Second year 4) Fourth year and above

9. The educational status of your mother:

1) No education 4) Secondary vocational education

2) Primary education 5) Higher education

3) Secondary education 6) I don't know / refuse to answer

10. The educational status of your father:

1) No education 4) Secondary vocational education

2) Primary education 5) Higher education

3) Secondary education 6) I don't know / refuse to answer

11. The employment status of your mother:

1) Employed 3) Pensioner

2) Unemployed 4) Don't know/refused to answer

12. The employment status of your father

1) Employed 3) Pensioner

2) Unemployed 4) Don't know/refused to answer

13. How do you rate the income level of your family?

1) Below average 3) Above average

2) Average 4) Don't know/refused to answer

14. Do you have the opportunity to earn extra money?

1) Yes 2) No

15. How much do you spend on food each month (in rubles)?(write):_____

16. Do you live the NEFU dormitory?

1) Yes 2) No

17. Are you satisfied with the living conditions in the hostel or the services of NEFU in general?

1) Yes 2) No

Block 2. Anthropometric characteristics (body weight and height)

18. Your weight (write):_____

19. Your height (write):_____

Block 3. Nutrition Knowledge

This is a survey, not a test. Your answers will help identify which dietary advice people find confusing. It is important that you complete it by yourself. If you don’t know the answer, mark “not sure” rather than guess.

20. Which of the diseases is related to a low intake of fiber?

1) Bowel disorders 3) Dental caries

2) Anemia 4) Not sure

21. Which of these diseases is related to how much sugar people eat?

1) High blood pressure 3) Anemia

2) Dental caries 4) Not sure

22. Which of the diseases is related to how much salt (or sodium) people eat?

1) Hypothyroidism 3) High blood pressure

2) Diabetes 4) Not sure

23. Which of these options do experts recommend to reduce the chances of getting cancer?

1) Drinking alcohol regularly 3) Avoiding additives in food

2) Eating less red meat 4) Not sure

24. Which of these options do experts recommend to prevent heart disease?

1) Taking nutritional supplements 3) Eating less trans-fats

2) Eating less oily fish 4) Not sure

25. Which of these options do experts recommend to prevent diabetes?

1) Eating less refined foods 3) Eating more processed meat

2) Drinking more fruit juice 4) Not sure

26. Which one of these foods is more likely to raise people's blood cholesterol?

1) Eggs 3) Animal fat

2) Vegetable oils 4) Not sure

27. Which one of these foods is classified as having a high glycemic index (high glycemic index means a greater rise in blood sugar after eating)?

1) Wholegrain cereals 3) Fruit and vegetables

2) White bread 4) Not sure

28. To maintain a healthy weight people should cut fat out completely.

1) Agree 2) Disagree 3) Not sure

29. To maintain a healthy weight people should eat a high protein diet.

1) Agree 2) Disagree 3) Not sure

30. Eating bread always causes weight gain.

1) Agree 2) Disagree 3) Not sure

31. Dietary fiber can decrease the chances of gaining weight.

1) Agree 2) Disagree 3) Not sure

32. Reading food labels can help people to maintain a healthy weight.

1) Yes 2) No 3) Not sure

33. Taking nutritional supplements can help people to maintain a healthy weight.

1) Yes
2) No
3) Not sure

34. If someone has a Body Mass Index (BMI) of 23kg/m2, what would their weight status be?

1) Underweight 3) Overweight 5) Not sure
2) Normal weight 4) Obese

35. If someone has a Body Mass Index (BMI) of 31kg/m2, what would their weight status be?

1) Underweight 3) Overweight 5) Not sure
2) Normal weight 4) Obese

36. Which of these body shapes increases the risk of cardiovascular diseases (for example, angina, heart attack, heart failure, stroke, etc.)?

1) Apple shape 2) Pear shape 3) Not sure

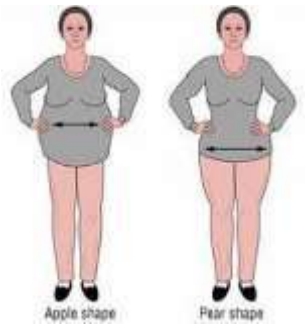

Figure B – Apple and pear body shapes

Block 4. Attitudes towards nutrition

Please read each statement and choose the one most appropriate to you.

37. I am confident to eat a healthy snack, like a fruit/ vegetable, when hunger.

1) Strongly disagree
2) Disagree
3) Neither agree nor disagree
4) Agree
5) Strongly agree

38. I am confident to eat fruits/ vegetables instead of cake, cookies, candy, ice cream, or other sweets for dessert.

1) Strongly disagree
2) Disagree
3) Neither agree nor disagree
4) Agree
5) Strongly agree

39. My family/friends encourage me to eat fruits and vegetables.

1) Strongly disagree
2) Disagree
3) Neither agree nor disagree
4) Agree
5) Strongly agree

40. I eat enough fruits and vegetables to control my weight.

1) Strongly disagree
2) Disagree
3) Neither agree nor disagree
4) Agree
5) Strongly agree

41. I eat enough fruits and vegetables to keep me healthy.

1) Strongly disagree
2) Disagree
3) Neither agree nor disagree
4) Agree
5) Strongly agree

Block 5. Dietary intake

The next set of questions asks about the types of foods/drinks that you ate/drunk on average during the last 7 days. Please read each statement and choose the one most appropriate to you.

42. How often did you eat cereals like wheat, rice, oat, corn/maize or foods made from these cereals? (e.g. bread, noodles, macaroni, corn flakes, porridge, etc.)

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

43. How often did you eat roots & tubers like potatoes, sweat potatoes, yams, cassava, etc?

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

44. How often did you eat vegetables? (eg. carrots, spinach, broccoli, cabbage, onions, garlic, lettuce, cucumber, tomato, etc)

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

45. How often did you eat fruits? (eg. apples, oranges, mandarins, grapefruit, bananas , grapes, , strawberries, ,etc)

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

46. How often did you eat meat and meat products (eg. beef, pork, chicken, sausages, etc)?

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

47. How often did you eat eggs?

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

48. How often did you eat fish and sea foods?

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

49. How often did you eat legumes and nuts? (eg. beans, soybeans, peas, lentils ,nuts, etc)

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

50. How often did you use dairy products? (eg milk, yogurt, cheese, etc)

1) Never
2) Once a week

3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

51. How often did you use oil, fat or butter?

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

52. How often did you use sauces and other condiments? (eg. Soy sauce, hot sauce, tomato ketchup, mayonnaise, etc)

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

53. How often did you drink fizzy drinks? (e.g. Coca cola, lemonade, pepsi, etc)?

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

54. How often did you drink hot drinks? (Tea and coffee)

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

55. How often did you eat sweets and snacks? (eg .sweets, chocolate, biscuits, honey, cakes, pastries, ice cream,etc)

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

56. How often did you drink alcohol? (eg wine, beer, vodka,etc)

1) Never
2) Once a week
3) 2-3 times a week
4) 4-6 per week
5) Once a day
6) More than once a day

57. Which meal do you usually prefer?

1) Only home cooked food 3) Both

2) Only purchased food

58. Do you often skip meals?

1) Yes

2) No, If no skip to question 60

59. Which meal do you skip? (Tick any that apply)

1) Breakfast 2) Lunch 3) Dinner

60. Do you eat snacks between meals?

1) Yes

2) No, If no skip to question 62

61. What is your favorite snack? (write)_____

62. How often do you add salt to food?

1) Always 3) Sometimes 5) Never

2) Usually 4) Rarely

63. Have you taken any vitamins, minerals, fish oils, or other dietary supplements?

1) Yes

2) No, If no skip to question 65

64. What type of dietary supplement did you take? (write) _____

Block 6. Eating behavior

Here are a number of questions regarding your behavior associated with eating. Choose the option that best fits your eating behavior in each of the situations described.

65. If your weight starts to increase, do you eat less than usual?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

66. Do you try to eat less than you would like, during your regular meal (eg breakfast, lunch, dinner)?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

67. Do you often refuse to eat and drink because you are worried about your weight?

1) Never
2) Seldom
3) Sometimes
4) Often
5) Very Often

68. Are you careful about how much you eat?

1) Never
2) Seldom
3) Sometimes
4) Often
5) Very Often

69. Do you deliberately choose food to lose weight?

1) Never
2) Seldom
3) Sometimes
4) Often
5) Very Often

70. If you overeat, will you eat less the next day?

1) Never
2) Seldom
3) Sometimes
4) Often
5) Very Often

71. Do you try to eat less so as not to put on weight?

1) Never
2) Seldom
3) Sometimes
4) Often
5) Very Often

72. Do you often try not to eat between regular meals because you are watching your weight?

1) Never
2) Seldom
3) Sometimes
4) Often
5) Very Often

73. Do you often try not to eat in the evening because you are watching your weight?

1) Never
2) Seldom
3) Sometimes
4) Often
5) Very Often

74. Does your weight matter when you eat?

1) Never
2) Seldom
3) Sometimes
4) Often
5) Very Often

75. Do you feel like eating when you are irritated?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

76. Do you feel like eating when you have nothing to do?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

77. Do you feel like eating when you are depressed or discouraged?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

78. Do you feel like eating when you are lonely?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

79. Do you feel like eating when someone has let you down?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

80. Do you have a desire to eat when something hinders you, gets in your way, or your plans are violated, or something does not work out?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

81. Do you have a desire to eat when you foresee some kind of trouble?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

82. Do you feel the urge to eat when you are anxious, anxious, or tense?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

83. Do you have a desire to eat when “everything is wrong”, “everything falls out of hand”?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

84. Do you feel like eating when you are scared?

1) Never 2) Seldom 3) Sometimes

4) Often 5) Very Often

85. Do you have a desire to eat when you are disappointed, when your hopes are destroyed?

1) Never 3) Sometimes 5) Very Often
2) Seldom 4) Often

86. Do you have a desire to eat when you are excited, upset?

1) Never 3) Sometimes 5) Very Often
2) Seldom 4) Often

87. Do you have a desire to eat when you are bored, tired, and restless?

1) Never 3) Sometimes 5) Very Often
2) Seldom 4) Often

88. Do you eat more than usual when the food is delicious?

1) Never 3) Sometimes 5) Very Often
2) Seldom 4) Often

89. If food looks good and smells good, do you eat more than usual?

1) Never 3) Sometimes 5) Very Often
2) Seldom 4) Often

90. If you see delicious food and smell it, do you eat more than usual?

1) Never 3) Sometimes 5) Very Often
2) Seldom 4) Often

91. If you have something tasty, would you eat it immediately?

1) Never 3) Sometimes 5) Very Often
2) Seldom 4) Often

92. If you pass by a bakery (pastry shop), do you want to buy something tasty?

1) Never 3) Sometimes 5) Very Often
2) Seldom 4) Often

93. If you pass by a diner or cafe, do you want to buy something delicious?

1) Never 3) Sometimes 5) Very Often
2) Seldom 4) Often

94. If you see others eating, do you feel like eating?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

95. Can you stop if you eat something tasty?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

96. Do you eat more than usual in the company (when others eat)?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

97. When you cook food, how often do you taste it?

1) Never 3) Sometimes 5) Very Often

2) Seldom 4) Often

Block 7. Health status and life style

Please read each statement and choose or write the one most appropriate to you.

98. In general, would you say your health is:

1) Poor 3) Good 5) Excellent

2) Satisfactory 4) Very good

99. Have you sought medical help in the last six months or in the last year?

1) Yes 2) No

100. On average, how many hours of sleep do you usually get in one day? (write)_____

101. Do you smoke?

1) Yes 2) No

102. Did your parents have a history of overweight or obesity?

1) Yes 3) I don't know / refuse to answer

2) No

Block 8. Psychological distress

Below is a list of the ways you might have felt or behaved. Please read each one carefully and decide how much the symptoms bothered or distressed you during the last week.

103. Suddenly scared for no reason.

1) Not at all 3) Quite a bit

2) A little 4) Extremely

104. Feeling fearful.

1) Not at all 3) Quite a bit

2) A little 4) Extremely

105. Faintness, dizziness or weakness.

1) Not at all 3) Quite a bit

2) A little 4) Extremely

106. Feeling tense or keyed up.

1) Not at all 3) Quite a bit

2) A little 4) Extremely

107. Blaming yourself for things.

1) Not at all 3) Quite a bit

2) A little 4) Extremely

108. Difficulties in falling asleep or staying asleep.

1) Not at all 3) Quite a bit

2) A little 4) Extremely

109. Feeling blue/sad.

1) Not at all 3) Quite a bit

2) A little 4) Extremely

110. Feelings of worthlessness.

1) Not at all 3) Quite a bit

2) A little 4) Extremely

111. Feeling everything is an effort.

1) Not at all 3) Quite a bit

2) A little 4) Extremely

112. Feeling hopeless about the future.

1) Not at all 3) Quite a bit

2) A little 4) Extremely

Block 9. Social Support

Please read each statement and choose the one most appropriate to you.

113. How many people are so close to you that you can count on them if you have great personal problems?

1) 'none ' 2) '1–2' 3) '3–5' 4) '5+'

114. How much interest and concern do people show in what you do?

1) 'none' 3) 'uncertain' 5) 'a lot'

2) 'little' 4) 'some'

115. How easy is it to get practical help from friends/neighbors if you should need it?

1) 'very difficult' 3) 'possible' 5) 'very easy'

2) 'difficult' 4) 'easy'

Block 10. Physical activity and sedentary behavior

The following questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

116. During the last 7 days, did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

1) Yes 2) No , if no skip to question 119

117. How many days did you do "vigorous physical activity"? (write)

_____Days per week

118. How much time did you usually spend doing vigorous physical activities on one of those days? (write)

_____hours per day. _____minutes per day.

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

119. During the last 7 days, did you do moderate physical activity, such as carrying light loads, cycling at a normal pace, or doubles tennis? Don't include walking.

1) Yes 2) No, If no skip to question 122

120. How many days did you do moderate physical activities? (write) ___days per week.

121. How much time did you usually spend doing moderate physical activities on one of those days? (write)

_____ hours per day. _____ minutes per day.

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, etc.

122. During the last 7 days, have you walked for at least 10 minutes at a time?

1) Yes 2) No, If no skip to question 125

123. How many days did you walk for at least 10 minutes at a time? (write)

_____Days per week

124. How much time did you usually spend walking on one of those days? (write)

_____ hours per day. _____ minutes per day.

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television, but do not include time spent on sleeping.

125. During the last 7 days, how much time did you spend sitting on a week day? (write) _____ hours per day. _____minutes per day.

Thank you very much!

Appendix C. Act of implementation

МИНОБРНАУКИ РОССИИ
Федеральное государственное автономное образовательное учреждение высшего образования «Северо-Восточный федеральный университет им. М.К. Аммосова» (СВФУ)
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25.03.2024 № 05-287/1
на №_____от_____

«УТВЕРЖДАЮ»
Проректор по образовательной деятельности ФГАОУ ВО «СВФУ имени М.К. Аммосова»
д.п.н. _____ / А.И. Голиков
“ ” 2024 г

АКТ
о внедрении результатов исследования

Результаты диссертационного исследования Менгиста Гетнета Абебе на тему: «Медицинские и социальные факторы, влияющие на избыточную массу тела, ожирение и пищевое поведение студенческой молодежи и разработка мер по их профилактике», представленной на соискание ученой степени кандидата медицинских наук, а именно электронное учебное пособие «Здоровьесбережение – образ жизни современного студента», внедрены в учебно-педагогический процесс кафедры организации здравоохранения и профилактической медицины Медицинского института ФГАОУ ВО «Северо-Восточный федеральный университет имени М.К. Аммосова».

Директор Медицинского института
ФГАОУ ВО СВФУ имени М.К. Аммосова
кандидат медицинских наук, доцент Н.М. Гоголев