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Montenegro Nutrition Survey 2022

MONTENEGRO NUTRITION SURVEY 2022 (MONS 2022)

FINAL REPORT – JUNE 2023

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ABBREVIATIONS

AGP	Alpha-1-acid glycoprotein
AROPE	At risk of poverty or social exclusion
BRINDA	Biomarkers Reflecting Inflammation and Nutritional Determinants of Anaemia
CBC	Complete blood count
CI	Confidence interval
COSI	European Childhood Obesity Surveillance Initiative
CRP	C-reactive protein
DHS	Demographic and Health Survey
ELISA	Enzyme-linked immunosorbent assay
Hb	Haemoglobin
HbA1c	Glycated haemoglobin
IPH	Institute of Public Health of Montenegro
IYCF	Infant and young child feeding
KCCG	Clinical Centre of Montenegro (abbreviation in Montenegrin)
MCV	Mean corpuscular volume
MICS	Multiple Indicator Cluster Survey
MoH	Ministry of Health
MONS	Montenegro Nutrition Survey
NCD	Non-communicable disease
NPW	Non-pregnant women of reproductive age (15–49 years)
PHC	Primary Healthcare Centre
PSC	Preschool-age children (6–59 months of age)
PSU	Primary Sampling Unit
PW	Pregnant women
RBP	Retinol-binding protein
UNICEF	United Nation’s Children Fund
WHO	World Health Organization

EXECUTIVE SUMMARY

Introduction

In Montenegro, data related to the health and nutritional status of the population has been scarce and previously no recent comprehensive assessment of nutritional status existed which measured both micro- and macro-nutritional indicators in any population group in Montenegro. Montenegro's 2018 Multiple Indicator Cluster Survey (MICS) provided the most recent representative data related to nutrition, but the survey only examined anthropometric markers in preschool children. This represented a notable data gap, particularly for vulnerable groups such as young children, women of reproductive age and pregnant women. Moreover, no recent comprehensive data was previously available on the prevalence of nutrition-related non-communicable diseases, which are among the main causes of death and significantly contribute to the disease burden in Montenegro.

The 2022 Montenegro Nutrition Survey (MONS) was conducted to measure the extent of micronutrient deficiencies and nutrition-related non-communicable diseases. By increasing the understanding of various nutritional conditions, the MONS will help policymakers design evidence-based nutritional intervention programmes for nationwide implementation. The MONS also provides a baseline against which to measure the future progress of the national nutrition programme. The MONS was conducted by the Institute of Public Health, UNICEF, GroundWork and other stakeholders with the financial support of the European Union.

Aim and objectives

The aim of the MONS was to obtain updated and reliable information on the current micronutrient and nutritional situation of several target groups living in Montenegro. The target population groups of the MONS were preschool children aged 6–59 months, non-pregnant women of reproductive age (15–49 years) and pregnant women. For preschool children and non-pregnant women, most of the indicators measured were representative at the national level and for each of the three strata representing the three regions (the south, centre and north). Data collected from pregnant women was only representative at the national level, as the small number surveyed precluded stratum-specific conclusions.

The objectives of the MONS included assessing the nutritional and micronutrient status, and estimating the extent and severity of nutrition-related non-communicable diseases in the target groups, evaluating infant and young child feeding (IYCF) practices, assessing the association between various factors and anaemia, and other deficiencies or conditions.

The key nutrition and micronutrient indicators were: anaemia in preschool children, non-pregnant women and pregnant women; iron deficiency (including iron deficiency anaemia) in preschool children and non-pregnant women; vitamin A deficiency in preschool children and non-pregnant women; vitamin D deficiency in preschool children, non-pregnant women and pregnant women; and folate deficiency among non-pregnant women. Nutrition-related non-communicable disease patterns were assessed by measuring glycated haemoglobin, triglycerides, high-density lipoproteins (HDL), and blood pressure in non-pregnant and pregnant women. Additionally, waist circumference was measured in non-pregnant women.

Design

The MONS 2022 was designed as a national cross-sectional survey with three strata. The census enumeration areas (EAs) from the 2011 census served as the sampling frame for the MONS. A two-stage sampling procedure was used to randomly select households containing preschool children, non-pregnant women or pregnant women.

In the first stage of sampling, the MONS used primary sampling units (PSUs) selected from the complete list of the 2011 census EAs with equal probability using simple random sampling. The selection of PSUs was done separately for each of the three strata (south, centre and north). Different numbers of PSUs were randomly selected from each of the strata in order to obtain the desired stratum-specific precisions. This was done because of stratum-level differences in the household size, the household composition and the response rates. Thus, the MONS included the following number of PSUs in the different strata: south – 73; centre – 75; north – 65. This resulted in 213 PSUs selected for the entire survey sample.

The second stage of sampling within each PSU consisted of the selection of all preschool children, all pregnant women, and 50 per cent of non-pregnant women in the southern and central strata and 33 per cent of non-pregnant women in the northern stratum.

Results

The MONS recruited 466 preschool children, 1633 non-pregnant women and 65 pregnant women. While the response rates for non-pregnant women were higher than anticipated, the response rates and sample sizes for children and pregnant women were lower than expected.

In this executive summary, only national estimates are presented in Table 1. Among children 6–23 months of age, 75 per cent had ever been breastfed, but only 45 per cent were put to the breast within one hour of delivery. Regarding complementary feeding, the majority of children have diets that meet the minimum criterium for diversity and meal frequency, but the compound indicator “minimum acceptable diet” is found only in about a half of children.

Anaemia is found in 13 per cent of children aged 6–59 months, denoting only a “mild” public health problem, according to criteria set by the World Health Organization (WHO). In contrast, more than 40 per cent of children are iron-deficient and nearly all anaemic children have concurrent iron deficiency. Vitamin D deficiency is low in children, but the combined prevalence of vitamin D deficiency and insufficiency affects approximately 22 per cent of children.

Among non-pregnant women, more than 75 per cent have a minimally diverse diet. In contrast to children, more than 25 per cent of non-pregnant women are anaemic, denoting a "moderate" public health problem, according to the WHO criteria. Nearly 60 per cent of non-pregnant women are iron-deficient and nearly all anaemic women have concurrent iron deficiency. Almost 20 per cent of non-pregnant women are folate-deficient and folate deficiency is highest among adolescent girls between 15 and 19 years of age (33%). While vitamin D deficiency affects fewer than 10 per cent of women, combined vitamin D deficiency and insufficiency is more common (>40%).

Indicators of cardiometabolic health show that, while there are few cases of pre-diabetes (defined as glycated haemoglobin (HbA1c) ≥5.7% to <6.5%) or diabetes (defined as HbA1c ≥6.5%), cardiovascular health and obesity indicators affect a notable proportion of women. More than 30 per cent of non-pregnant women have low HDL cholesterol and more than 40 per cent have a high triglyceride/HDL ratio. Nearly 50 per cent of non-pregnant women have central/visceral obesity, and approximately 15 per cent are hypertensive. Overall, more than 11 per cent of non-pregnant women have metabolic syndrome – a condition where three or more poor metabolic health indicators are found in the same person.

Among pregnant women, the prevalence of minimum dietary diversity is 87 per cent, which is notably higher than in non-pregnant women. The prevalences of anaemia, vitamin D deficiency, and vitamin D deficiency and insufficiency are similar to those found in non-pregnant women. Pregnant women have a high prevalence of elevated triglycerides (45%), and approximately 63 per cent have an elevated triglyceride/HDL ratio. In addition, approximately 9 per cent of pregnant women are hypertensive.

Table 1. Summary of the results of the MONS 2022

Target group	Indicator [a]	Result (%)	Table [b]
Children aged 6–23 or 6–59 months			
6–23 months	Ever breastfed	75.5	Table 14
	Early initiation of breastfeeding	45.4	
	Exclusive breastfeeding for the first two days after birth	55.4	
	Introduction of solid foods (6–8 months)	94.7	
	Minimum dietary diversity	74.7	
	Minimum meal frequency	87.3	
	Minimum acceptable diet	58.0	
	Bottle-fed in the past 24 hours	73.5	
6–59 months	Anaemia	13.2	Table 18
	Iron deficiency	40.7	
	Iron deficiency anaemia	9.3	
	Vitamin A deficiency	0.3	-
	Vitamin D deficiency	3.6	Table 19
	Vitamin D deficiency or insufficiency	22.4	
Non-pregnant women (15–49 years)			
	Meets minimum dietary diversity	75.6	Table 26
	Anaemia	25.8	Table 38
	Iron deficiency	58.3	
	Iron deficiency anaemia	23.0	
	Vitamin A deficiency	0.2	-
	Folate deficiency	19.7	Table 39
	Vitamin D deficiency	9.7	Table 40
	Vitamin D deficiency or insufficiency	42.8	
	Diabetes mellitus	0.5	Table 31
	Elevated triglycerides	13.9	Table 32
	Low HDL cholesterol	30.4	
	Elevated triglyceride/HDL ratio	40.5	
	Visceral/central obesity	48.5	Table 33
	Hypertension	14.7	Table 34
	Metabolic syndrome	11.4	Table 35
Pregnant women			
	Meets minimum dietary diversity	87.0	Table 26
	Anaemia	29.7	Table 51
	Vitamin D deficiency	9.5	Table 52
	Vitamin D deficiency or insufficiency	50.9	
	Diabetes mellitus	0.0	Table 50
	Elevated triglycerides	44.7	
	Low HDL cholesterol	7.9	
	Elevated triglyceride/HDL ratio	63.4	
	Hypertension	9.3	

[a] See text of method section for case definitions.

[b] Refer to the table indicated for more detailed analysis of the outcome, including group-specific results by age, region, wealth quintiles and other analyses.

Discussion

Anaemia and micronutrient deficiencies

The results of the MONS show that anaemia is more common in women than in preschool children. Nonetheless, the prevalence of iron deficiency is high in both groups, and iron deficiency is likely responsible for the majority of cases of anaemia found. Nearly all anaemic children and women are iron-deficient, and iron deficiency is the only nutritional indicator that is significantly associated with anaemia in both children and women.

Iron deficiency is the most common micronutrient deficiency in Montenegro and affects about 40 per cent of children and almost 60 per cent of non-pregnant women. The prevalence of iron deficiency (roughly 70%) is particularly high in children 12–23 months of age and also tends to be higher in children living in urban centres. For non-pregnant women, the MONS found that taking multivitamin supplements is associated with a lower prevalence of iron deficiency. As multivitamins are prescribed less frequently than other vitamin or mineral supplements, the association between multivitamin consumption and iron deficiency may indicate that women are taking multivitamin supplements prophylactically and that additional iron included in the supplements increases women's iron stores. In contrast, non-pregnant women who take iron supplements have a higher prevalence of iron deficiency. While this finding is perhaps counterintuitive, the MONS found that more than 80 per cent of women consuming iron supplements were prescribed these supplements by their doctors. Thus, these results suggest that iron-deficient and anaemic non-pregnant women are being successfully diagnosed by Montenegro's healthcare system.

The MONS found that vitamin D deficiency is rare in children and affects nearly one tenth of women. Despite the relatively low deficiency levels, the combined prevalence of both vitamin D deficiency and insufficiency are high, particularly considering that skin-covering practices are rarely practised in both groups. The prevalence of both vitamin D deficiency and insufficiency were likely affected by the season when the MONS was conducted (i.e. autumn) as vitamin D status is predominantly driven by exposure to sun. Thus, one could anticipate that the prevalence of vitamin D deficiency and insufficiency in Montenegro would be lower during the spring/summer months and higher during the winter months, as exposure to sunlight increases and decreases, respectively, during these seasons. Similar seasonal findings have been observed in other European countries.

Nearly 20 per cent of non-pregnant women are folate-deficient, with significantly higher levels found in younger women. As macrocytosis was found in anaemic adolescent girls 15–19 years of age, it is likely that part of the anaemia in this age group is caused by folate deficiency. Folate deficiency can also cause neural tube defects during the early stages of gestation, thus, addressing folate deficiency can be used in Montenegro to both reduce anaemia and prevent birth defects.

The MONS found that vitamin A deficiency is nearly non-existent in Montenegrin women and children. While there is little population-representative data on vitamin A deficiency in

Europe, this finding is not surprising, as vitamin A deficiency in developed countries is rare, with the exception of individuals with diseases that cause lipid maldigestion or malabsorption.

Cardiometabolic health and metabolic syndrome

In addition to micronutrient deficiencies, the MONS identified multiple concerns related to the cardiometabolic health of women. The most concerning finding is that more than 10 per cent of women have metabolic syndrome. Individuals with metabolic syndrome have higher rates of diabetes, heart disease and certain cancers. Using 2022 population estimates and the prevalence of metabolic syndrome, there are an estimated 16,110 women 15–49 years of age with metabolic syndrome in Montenegro. This is a concern as the adverse health effects of metabolic syndrome are responsible for a sizable proportion of Montenegro's disease burden.

While the five components of metabolic syndrome are all highly associated with each other, some conditions, such as diabetes, are relatively rare. In contrast, the most common components of metabolic syndrome identified by the MONS are visceral/central obesity and low HDL cholesterol. Visceral/central obesity reflects a condition where an individual has excess adipose tissue, which is associated with increased circulating triglyceride levels and chronic inflammation. HDL cholesterol, often referred to as "good" cholesterol, removes other forms of cholesterol from the blood and subsequently helps to prevent heart disease.

In Montenegro, the most common "cluster" of conditions is low HDL cholesterol, visceral/ central obesity and elevated triglycerides; these concurrent conditions account for approximately half of the cases of metabolic syndrome observed in Montenegrin women. This "clustering" is accompanied by a relatively high prevalence of a high triglyceride/HDL ratio, which is a strong predictor of cardiovascular diseases and gestational diabetes. This "clustering" also indicates that metabolic syndrome in Montenegro is largely driven by obesity.

Smoking is also a serious public health problem in Montenegro. The MONS shows that smoking is practised by a large proportion of women, including pregnant and breastfeeding women. In addition to causing cancer, smoking is a main contributor to cardiovascular diseases, particularly by limiting the production of HDL cholesterol.

Cardiometabolic health and nutrition

The MONS found that women with vitamin D deficiency/insufficiency have significantly higher prevalences of elevated triglycerides, low HDL cholesterol or central/visceral obesity. These associations have been previously observed by researchers examining the linkages between vitamin D deficiency and metabolic health. A recent systematic review and meta-analysis found that vitamin D supplementation helps lower total cholesterol, LDL cholesterol and triglyceride levels, but not HDL cholesterol levels, with larger effects on total cholesterol and triglycerides found in subjects who were deficient in vitamin D at baseline. Regarding vitamin D and obesity, while the association between these two factors has been identified previously, the directionality of the association remains unclear. Obesity can result in lower circulating vitamin D concentrations, as vitamin D can be diluted by larger volumes of fat, serum, liver and muscle. At the same time, vitamin D deficiency limits the proliferation and creation of fat cells (adipogenesis) and thus could help to reduce the risk of obesity.

Recommendations

Address anaemia and iron deficiency via fortification

The prevalence of iron deficiency is high in both children and women, and iron deficiency is likely the main risk factor of anaemia in Montenegro. Increasing iron intake can be accomplished with multiple approaches. Multiple micronutrient fortification of staple foods (e.g. wheat flour), including iron and folic acid, is a population-level intervention that has been shown to reduce the prevalence of iron deficiency and folate deficiency, and is thus a viable approach to reduce the prevalence of anaemia and neural tube birth defects. Food balance sheet data from the Food and Agriculture Organization indicates that wheat flour is consumed in high amounts in Montenegro and could be a possible vehicle for food fortification.

Vitamin D supplementation during breastfeeding

Since the MONS found that approximately 16 per cent of breastfeeding women are deficient in vitamin D, a targeted supplementation programme should be considered. Vitamin D supplements targeted at breastfeeding women can be used to prevent osteoporosis, hypocalcaemia and hypertension. Thus, it is recommended that breastfeeding mothers are either screened for vitamin D deficiency during postnatal visits or prescribed prophylactic vitamin D supplements.

Improve vitamin D status via fortification

The prevalence of vitamin D deficiency and insufficiency are relatively high in children older than 12 months and in women. As such, the fortification of staple foods with vitamin D should be considered as an approach to increase vitamin D intake and to prevent the sequelae of vitamin D deficiency. According to the FAO’s 2020 food balance sheets, Montenegro has a high consumption of milk, and thus this is a potential food vehicle for fortification with vitamin D.

Improve infant and young child feeding practices

The MONS found that some breastfeeding and complementary feeding practices are suboptimal. Early initiation of breastfeeding reduces the risk of infections and feeding newborns liquids other than breastmilk after birth can adversely affect the practice of breastfeeding. It is plausible that insufficient information and/or support are provided to women during the antenatal and postnatal periods. As such, the continued expansion of the Baby-Friendly Hospital Initiative in Montenegro and breastfeeding counselling can be recommended. In addition, to clearly identify the barriers to optimal breastfeeding practices after birth, research about the breastfeeding support provided at hospitals/clinics and the breastfeeding knowledge, attitudes and practices of women that have recently given birth should be conducted.

In addition to breastfeeding, the minimum acceptable diet in children 6–23 months of age should be improved. As the MONS found that meal frequency of children 6–23 months of age was relatively high for all wealth quintiles, a lack of dietary diversity in low-wealth households is responsible for a low prevalence of the minimum acceptable diet. As such, supplemental nutrition programmes, income support programmes and/or awareness campaigns targeted at children in low-wealth/low-income households could be considered in order to improve the dietary diversity in children.

Address risk factors of metabolic syndrome

The MONS found that obesity is a key risk factor for metabolic syndrome. Diagnosis of obesity, rather than of other components of metabolic syndrome, is recommended, as obesity can be ascertained using non-invasive approaches and at a relatively low cost. Thus, it is imperative that doctors and healthcare providers have the knowledge and equipment to diagnose obesity in adults. In particular, measurement of waist circumference — the obesity measurement used by the MONS — should be used for obesity screening, as measurement of body mass index is a less sensitive indicator of cardiometabolic risk factors. Following a diagnosis of visceral/central obesity, other components of metabolic syndrome can be assessed.

At the population level, public health interventions to modify the food environment can be pursued. Demand-creation activities, such as educational campaigns and behaviour-change communication programmes have been shown, albeit inconsistently, to increase the consumption of vegetables in adults. Importantly, the most effective behaviour-change interventions engaged stakeholders during the design phase, and thus any future behaviour-change programme in Montenegro should be carefully designed in order to increase its effectiveness and sustainability. Although the MONS did not assess physical activity, the WHO has identified the promotion of physical activity as an approach to prevent and reduce overweight and obesity. This can include community-level programmes that encourage physical activity by modifying the “built environment” (e.g. sidewalks, bicycle lanes and exercise sites) and by promoting the benefits of active lifestyles.

Population-level programmes that encourage adults to quit smoking or prevent the commencement of smoking should also be pursued. Smoking prevention and cessation programmes can be seen as an approach to reduce the prevalence of both metabolic syndrome components and smoking-related cancers and diseases. Despite government taxes on cigarettes, the price of cigarettes in Montenegro is substantially lower than in countries in the European Union. The relatively low price of cigarettes is likely exacerbated by the illegal selling of tobacco products in Montenegro. As such, government policies to both tax cigarettes and obstruct the illegal trade of tobacco can be considered to be approaches to reduce the prevalence of smoking, and subsequently of metabolic syndrome.

Study focusing on the health and nutritional status of Roma communities in Montenegro

The MONS was not designed to produce representative results for children and women residing in Montenegro’s Roma communities. Montenegro’s 2018 MICS found that the prevalence of stunting in Roma children was nearly three times as high as in non-Roma children, and this may suggest that micronutrient deficiencies and other health problems are more common among Roma children and women. Thus, a comprehensive study that assesses the nutrition and health status of children and women in Montenegro's Roma communities should be considered.

1. INTRODUCTION

1.1. Country overview

Montenegro is in South-East Europe, and shares borders with Serbia, Kosovo (UNSCR 1244), Bosnia and Herzegovina, Albania and Croatia. It has a population of 631,000, and about one third of the population resides in rural dwellings [1]. Montenegro gained independence from the State Union of Serbia and Montenegro in 2006 and has experienced relative economic stability over the past 15 years, although the gross domestic product (GDP) dropped in 2020 due to the COVID-19 pandemic [2].

As of 2019, Montenegro ranked 52 out of the 189 countries evaluated in the Human Development Index (HDI). While 24 per cent of the population was considered as living below the national poverty line, only 4 per cent of the population was estimated to be vulnerable to multidimensional poverty and 0 per cent lived under the global absolute poverty line of 2 standardized USD a day [3]. However, according to Montenegro's 2021 Survey on Income and Living Conditions, children continue to be the most exposed to the risk of poverty compared to other age groups, with 30.5 per cent of children below 17 years of age at risk of poverty. Worryingly, 45.5 per cent of children less than 18 years of age are also at risk of poverty or social exclusion (per the AROPE indicator). This measurement shows that even more children are suffering from material and social deprivation beyond income-based poverty (children who are at risk of poverty and/or in severe material and social deprivation and/or live in households with very low work intensity) [4].

1.2. Nutritional situation of Montenegro's population

Undernutrition, including micronutrient deficiencies, must be overcome to achieve progress in human and economic development. Women of reproductive age, particularly during pregnancy and lactation, exhibit increased nutrient needs and are therefore a vulnerable population group. Additionally, because of the critical link between maternal and child nutrition, public health efforts have turned to ensuring adequate child nutrition during the first "1,000 days" — from conception to a child's second birthday. More recently, the importance of a continuum of adequate nutrition has been expanded to the window of 8,000 days to emphasize the importance of nutrition from birth to adolescence [5].

In Montenegro, there is scant data related to the health and nutritional status of Montenegro's population. Montenegro's 2018 Multiple Indicator Cluster Survey (MICS) [6] provides recent representative data related to nutrition, but only examined anthropometric markers in preschool children; no nutritional assessment was conducted on other population groups. For children under 5 years of age, chronic and acute malnutrition were found only among 7.2 per cent and 2.2 per cent of children, respectively [6]. Infant and young child feeding patterns were also evaluated and it was reported that while over 80 per cent of children had ever been breastfed, only about one fifth of children were exclusively breastfed during the first six months of their life; about half of the children received a minimum acceptable diet. In Roma settlements, chronic malnutrition (20.8%) and acute malnutrition (3.2%) were notably higher than in non-Roma communities. In Roma settlements, minimum acceptable diet and exclusive breastfeeding were only attained for about 20 per cent and 14 per cent of children, respectively.

The 2018 MICS found that 7.3 per cent of children under 5 years of age were overweight [6]. Among 7-year-old children, a 2019 study from IPH found that 18.1 per cent of boys and girls were overweight, and obesity among boys and girls was 16.1 per cent and 10.5 per cent, respectively [7]. Among women 20 years of age or older, the World Health Organization (WHO) estimated in 2008 that 49.9 per cent and 21.7 per cent were overweight and obese, respectively [8]. It is not clear, however, if these 2008 estimates were produced using statistical models or if representative survey data was collected. The 2019 estimates of the Global Burden of Disease (GBD) project show that in Montenegro 94 per cent of all deaths and 86 per cent of the country's disease burden are caused by non-communicable diseases [9].

The 2019 WHO global and regional anaemia estimates predicted that the anaemia prevalence among Montenegrin women and children was approximately 18 per cent [10]. As the WHO's 2010 anaemia estimates were approximately 28 per cent for both women and children [11], there appears to be a reduction in the anaemia prevalence in these target groups. Importantly, these estimates are derived from statistical models and are not based on actual data collected in Montenegro.

Data on micronutrient status were entirely missing for preschool children and women of reproductive age. An iodine survey in 2007 among school-age children found a median urinary iodine concentration of 174 µg/L, categorizing the country as 'adequate' in terms of iodine nutrition [12].

1.3. Programmes to combat micronutrient deficiencies in Montenegro

In Montenegro, food fortification is not mandatory for any food vehicles [13], but voluntary fortification of salt is being promoted. A coverage survey conducted with USAID and UNICEF support among households with pregnant women in 2017 and breastfeeding women in 2019 found that three quarters of households had access to adequately iodized salt [14]. The research showed that pregnant women in Montenegro have mild iodine deficiency, while there is no deficiency in breastfeeding mothers, but the established limit value implies the need for biomonitoring of the iodine intake of vulnerable groups, pregnant women, nursing mothers and children. There are at present no micronutrient powder programmes geared towards young children in Montenegro (UNICEF internal documentation); exclusive breastfeeding and appropriate and diverse complementary feeding for infants and young children are being promoted, although no coverage estimates of promotional activities are available. To this end, a dedicated breastfeeding commission was established in 2021.

Global goals and timeframes related to chronic non-communicable diseases related to food and nutrition and recommendations for reducing salt intake are incorporated in the

“Programme of Measures to Improve Nutrition and Nutritional Status” with Action Plan 2021–2022, the “Programme for Reducing Excessive Salt Intake from Food in Montenegro 2017–2025” and the “Programme for Control and Prevention of Non-Communicable Diseases in Montenegro” with Action Plan for the period 2019–2020 and in a special Action Plan for 2021. The first study on salt intake (sodium and potassium) in the population was conducted in 2018. This study showed that dietary salt intake amongst adults in Podgorica remains high – more than double the WHO recommended limit of 5g/day (11.6g salt/day). The Programme for Reducing Excessive Salt Intake from Food in Montenegro 2017–2025 recommends measures that should contribute to reducing the amount of salt intake in the population of Montenegro by 16 per cent of the initial measured values, or 30 per cent by 2025. The long-term goal is to reach an average level of per capita salt intake in Montenegro of below 5g per day in accordance with the current WHO recommendations.

The Programme of Measures to Improve Nutrition and Nutritional Status with Action Plan 2021–2022 arose from the need to continue harmonizing national activities with the regional recommendations adopted by the World Health Organization for the European Region (European Food and Nutrition Action Plan 2015–2020), but also to adopt the recommendations highlighted in the Final Report on the implementation of the Action Plan (Plan for the Implementation of the Programme of Measures to Improve Nutrition and Nutritional Status in Montenegro for 2020). In a three-year period, between two rounds of COSI research (2016 and 2019), the Institute of Public Health of Montenegro with the support of UNICEF developed and published “Guidelines for Nutrition of Preschool Children” and “Recommendations for Reducing Consumption of Foods High in Sugars, Saturated Fats, Trans Fats and Salt”, to improve children's nutrition and create an environment that promotes and supports proper nutrition.

Activities to reduce salt intake in food in Montenegro have been carried out for almost a decade and are in line with established national priorities and adopted strategic documents. According to the data from the Programme for Reduced Salt Intake in Montenegro 2017–2025, the salt content of commonly-consumed foods is too high and it is necessary to take measures to reduce excessive intake of so-called “hidden” salt (i.e. salt from processed foods). Product reformulation involves the gradual reduction of salt, sugar and fat, or replacement of certain nutrients in processed foods.

Although not formally documented, there are anecdotal reports of gynaecologists recommending multivitamins to pregnant women and women aiming to become pregnant. Further information about supplement consumption among children and women is required to identify possible sources of micronutrients, and determine if supplement consumption is associated with micronutrient status measures.

1.4. Rationale for the survey

Apart from anthropometric indicators in children, there was no recent comprehensive assessment of nutritional status measuring both micro- and macro-nutritional indicators in any population group in Montenegro, let alone for vulnerable groups such as young children, non-pregnant women of reproductive age, and pregnant women. Moreover, nutrition-related non-communicable diseases are one of the main causes of death and significantly contribute to Montenegro's disease burden [15]. The MONS was conducted to increase understanding of the severity of micronutrient deficiencies and nutrition-related non-communicable diseases, and provides policymakers with the evidence to design nutritional intervention programmes for nationwide implementation. The MONS also establishes a baseline against which to measure the future progress of the national nutrition programme. Furthermore, by including multiple target groups, the data produced by MONS can be used by different governmental agencies to design targeted nutrition programmes. Lastly, the survey simultaneously collected data on under-nutrition and over-nutrition, including non-communicable diseases, to provide information about the extent of the double burden of malnutrition.

1.5. Objectives and indicators

The MONS was nationwide in scope and collected data from three target groups: 1) preschool children aged 6-59 months (PSC); 2) non-pregnant women of reproductive age, 15–49 years (NPW); and 3) pregnant women of any age (PW). The indicators collected varied by population groups and are detailed below.

There were no *a priori* hypotheses in the MONS 2022 in Montenegro. The overall aim of this survey was to obtain updated and reliable information on the current micronutrient and nutritional situation of women and young children in Montenegro, as well as on the extent of non-communicable diseases among women. Primary and secondary objectives were proposed initially by the Institute of Public Health, UNICEF and other national stakeholders. The objectives of the MONS 2022 were subsequently revised by GroundWork, the Institute of Public Health and UNICEF during the protocol development process.

1.5.1. Primary objectives

1. To measure the prevalence and severity of anaemia in PSC, NPW and PW by measuring haemoglobin concentration from a complete blood count.
2. To measure the prevalence of iron deficiency in PSC and NPW using plasma ferritin concentration. Plasma ferritin was adjusted for the presence of inflammation [16] as indicated by elevated levels of C-reactive protein (CRP) and alpha-1-acid glycoprotein (AGP).
3. To measure the prevalence of vitamin A deficiency in PSC and NPW using retinol-binding protein (RBP), appropriately adjusted for inflammation, a sub-sample was measured for plasma retinol to validate the RBP results.
4. To assess the prevalence of vitamin D deficiency among PSC, NPW and PW by measuring serum 25[OH]D concentrations.

5. To measure the prevalence of folate deficiency among NPW measuring plasma folate concentrations.
6. To assess the prevalence of cardiometabolic risk factors and the prevalence of metabolic syndrome among NPW by measuring blood pressure, waist circumference, glycated haemoglobin (diabetes), triglycerides and high-density lipoproteins.
7. To measure the prevalence of diabetes in pregnant women using HbA1c.

1.5.2. Secondary objectives

Other variables which may influence various types of malnutrition or play a causative role were also assessed. Such additional variables included socio-economic status, individual food consumption patterns (individual dietary diversity), infant and young child feeding and breastfeeding practices, intake of micronutrient supplements, and others.

2. METHODOLOGY

2.1. Geographical scope and basic sampling frame

The sampling universe consisted of all preschool children 6–59 months, non-pregnant women 15–49 years, and pregnant women of any age residing in Montenegro at the time of the survey data collection activities, regardless of citizenship or nationality. To make separate estimates of each outcome for Montenegro's administrative regions, three explicit strata were defined to represent the three regions (south, centre and north). Separate samples were selected for each stratum, and produced stratum-specific and, when combined and appropriately statistically weighted, nationally representative estimates. The approach for the MONS enabled the calculation of sufficiently precise estimates for each stratum to make stratum-specific conclusions and recommendations about preschool children and non-pregnant women. For pregnant women, only national estimates could be obtained with reasonable precision.

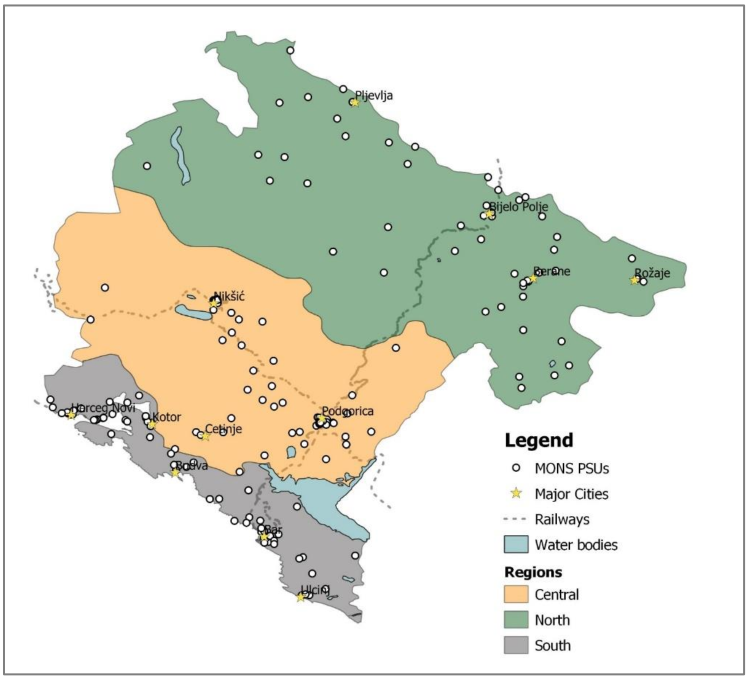

Figure 1. Montenegro's statistical regions and PSUs selected for MONS

2.2. Sampling approach and sample size determination

The MONS was a cross-sectional stratified survey based on a sample large enough to produce stratum-specific estimates for priority nutrition indicators. These estimates have acceptable precision for decision makers to draw conclusions and make programme decisions. The MONS comprised three strata: the south, the centre and the north. Using Montenegro's 2011 census enumeration areas (EAs) as the sampling frame, the first stage of sampling consisted of EAs selected using simple random sampling from each of the southern, central and northern strata. The 2011 census EAs [17] were used because no information from Montenegro's upcoming census was available during the planning of the MONS.

Due to differences in the household composition and household size, as well as the average size of the EAs and the individual response rates between the different regions, different numbers of EAs were randomly selected in each of the three strata to obtain the desired stratum-specific precisions. Overall, the MONS randomly selected 213 PSUs: 73 in the southern, 75 in the central and 65 in the northern strata.

The selection of individuals in the EAs was done after conducting a listing of all preschool children, non-pregnant women and pregnant women residing in the EA. Maps showing the boundaries of the EA were used to ensure that only individuals in a selected EA were listed. All preschool children and pregnant women residing in the selected EAs were eligible to participate in the MONS, and survey listers thus attempted to recruit all these individuals. Due to the relatively large number of non-pregnant women, however, only 50 per cent of non-pregnant women in each selected EA of the southern and central strata were randomly selected. In the northern stratum, every third non-pregnant woman (33.3%) was randomly selected. Random selection was done with equal probability using random number tables so that the selection procedure implemented by the teams could be easily monitored.

Response rates were based on the response rates of the MICS 2018, and separate response rates for each target group and stratum were used as part of the sample size calculations. The response rates for blood collection were assumed to be 10 percentage points lower than the general response rates found by the MICS 2018. All assumptions made and used to calculate the required sample sizes are presented in **Appendix 8.4** and were assumed as follows: for preschool children, all calculations assumed response rates of 80 per cent, 46 per cent and 58 per cent in the northern, central and southern strata, respectively, for questionnaire data; response rates for blood were assumed to be 10 percentage points lower and thus 70 per cent, 36 per cent and 48 per cent, respectively. For women (pregnant and non-pregnant) response rates for questionnaire data were assumed to be 77 per cent, 39 per cent and 51 per cent in the northern, central and southern strata, respectively; response rates for blood were assumed to be 10 percentage points lower and thus 67 per cent, 29 per cent and 41 per cent, respectively.

For children 6–59 months of age, selection of 213 EAs in total should have resulted in the recruitment and completion of questionnaires of approximately 1172 survey subjects, and 979 biological specimens collected. For non-pregnant women, 1754 subjects were expected to provide questionnaire data, and of those 1404 should have had biological specimens collected. Further, it was estimated that about 180 pregnant women provided questionnaire data and 146 agreed to have their blood collected.

2.3. Study populations

Table 2 lists the inclusion criteria for enrolment into the survey, disaggregated by target population group. There were no specific exclusion criteria other than the negation of the inclusion criteria.

Table 2. Inclusion criteria by targeted population group

Target population	Inclusion criteria
Children 6–59 months	• Age between 6 and 59 months of age at the time of survey data collection • Mother or caregiver gives written consent for interview and collection of biological specimens
Non-pregnant women	• Age 15–49 years at the time of survey data collection • Currently non-pregnant by self-report • Give written consent for survey data collection; mother or caregiver gives written consent for interview and collection of biological specimens for adolescent girls 15 to 18 years of age.
Pregnant women	• Currently pregnant by self-report • Give written consent for survey data collection; mother or caregiver gives written consent for interview and collection of biological specimens for adolescent girls 15 to 18 years of age.

2.4. Ethical considerations

In order to ensure that the survey followed principles to protect respondents and prevent unnecessary risk to survey respondents, ethical approval for the study was obtained from the Ethical Board at the Institute of Public Health of Montenegro (see **Appendix 8.5** for the approval letter). The survey was conducted in line with the UNICEF procedure for ethical standards in research, evaluation, data collection and analysis [18] and followed UNICEF's ethical reporting guidelines [19]. Furthermore, the survey respected UNICEF's Child Protection Code, and the utmost care was taken that no human rights were violated, and the survey complied with all the principles of the international human rights framework [20].

The selected women, as well as the caregivers of the selected children and females 15 to 18 years of age were read the consent form, which stated that participation in the MONS was voluntary and that participants could withdraw from the survey at any point including before giving blood sample. After the consent form was read to the participant, they were asked to provide written informed consent (see **Appendix 8.6**). Written informed consent was required from all individual participants. Interviews, measurements (e.g. blood pressure) and blood taking was conducted in the households of selected individuals.

Confidentiality of information from the respondents was upheld with the utmost care throughout data collection, processing and analysis. Identifying records, in both electronic and paper form, was stored under lock and key (or password) at all times and access granted only to specifically identified survey personnel. Specific identifying information was stripped from all electronic databases used by the survey management team for data analysis and for submission of the databases to national stakeholders.

No children younger than 6 months were included in the survey, to protect them from undue discomfort due to the blood collection. Furthermore, if the first attempt of blood sampling failed, the technicians asked the participant (or caregiver) if they agreed to a second attempt. If granted and the second attempt failed, no more sampling attempts were made.

Participants diagnosed with severe anaemia or diabetes were referred to a health facility the day after the data was collected. As part of the survey, individuals were asked to provide their national health ID number, which enabled MONS to add certain biological results (e.g. complete blood count, HbA1c, total and HDL cholesterol) to the individuals' health accounts on the "e-zdravlje" health portal — the health portal used by Montenegro's citizens and healthcare providers. In addition, vitamin D and folate results were sent by SMS or an online messaging platform to participants, as these analyses could not readily be added to the "e-zdravlje" portal.

Although this procedure presented a potential breach of the confidentiality statement above, it was deemed a necessary step to provide results to participants. If an individual did not wish to share their health ID number, all the data collection continued, and the individual was told that they would not have access to their results.

2.5. Fieldwork and data collection

This chapter provides a description of the approach taken to collect data in the field and includes operational details about how the MONS fieldwork was conducted. Of note, the operational procedures for data collection in the field were adapted to the COVID-19 situation as it evolved, but it was anticipated that particular measures needed to be put in place. These included proper hygiene precautions and specific messaging to raise awareness and ensure survey participation by the Montenegrin population. Applied measures were based on the guidelines for population-based surveys during the COVID pandemic [21].

2.5.1. Community mobilization and sensitization

In the MICS 2018, individual response rates were quite low. Nationally, only about 55 per cent of non-pregnant women and 61 per cent of preschool children participated in the MICS 2018, with much lower response rates in the central stratum – the capital, Podgorica. As the MICS is predominantly a questionnaire-based survey, these low response rates were a considerable concern for the national nutrition survey, which required blood samples from all participating individuals. As such, the MONS, which is a more invasive survey, was expected to have a lower response rate than the MICS.

As a low response rate was expected, efforts to improve the response rates were undertaken as part of the implementation of this survey. First, to ensure that there was widespread awareness of the survey, stakeholders organized a rigorous mass-media communications campaign, including social media posts and videos, radio/television guest appearances, a dedicated website and banners on the websites of the IPH, UNICEF and Roditelji.me, and press releases prior to the start of fieldwork. This campaign was organized by the Institute of Public Health and UNICEF and was funded by the European Union. Second, to further encourage the selected individuals to take part in the survey, individual results were placed on Montenegro's individual online health portal. This allowed participants to check on their status once the results became available. For the results available immediately (e.g. blood pressure), feedback was provided to participants on the spot and if needed, they were referred for further treatment.

2.5.2. Instrument translation, pre-testing, training and piloting

Questionnaires and other critical instruments were originally written in English then translated into Montenegrin and, in the case of questionnaires, back-translated into English by a different translator to check for translation accuracy. The survey questionnaires were pre-tested by the survey management team; this related in particular to the questionnaire flow and the different response options.

Training for the survey team members consisted of classroom instruction and practice, and of field testing of all survey procedures. Interviewer training included discussion of each question, practice reading, role playing and instruction on how to use the electronic question software on a tablet computer. As a part of their training, interviewers assisted in the field testing and final revision of the questionnaire questions to ensure their clarity and cultural appropriateness. For large parts of the training, the interviewers underwent separate training from that of the medical sub-team. The latter was trained in measuring blood pressure, waist circumference and blood sampling procedures, which included rigorous training on maintenance of a cold chain to transport blood specimens.

For the field testing, teams were given a chance to practise all the survey procedures under very close supervision in communities that were not part of the MONS's 213 PSUs. For this, survey the teams practised all the data collection steps in households of selected individuals from communities in the vicinity of Podgorica but who were not included in the survey sample. The teams conducted the listing and selection of individuals, interviewing, on-site measurements and phlebotomy, and practised the transportation of specimens to a blood processing point.

The initial supervision during the first few days of fieldwork was very intense and attempts were made to have each team accompanied by one supervisor during this early stage to detect and correct any remaining flaws in the procedures and approaches taken. Subsequently, a reduced team of supervisors undertook periodic visits to check on the progress of the teams.

2.5.3. Survey team composition

Data collection in the MONS survey was done by 11 teams, each consisting of a medical doctor, who conducted the interviews, and a paediatric phlebotomist.

Additionally, two regional supervisors were appointed to assist the survey teams with introductions to local authorities, arranging the logistics of transport and lodging, and other services, as necessary.

2.5.4. Listing of eligible individuals and selection of non-pregnant women

During the listing exercise, information about whether an eligible person was living in a household was collected. For households with at least one eligible person, information on the head of the household (e.g. name and telephone number) along with information helping to locate the household (address or description of location) was collected. This listing was conducted by trained listers just prior to the beginning of survey data collection and was recorded on paper to facilitate random selection of non-pregnant women.

The listing exercise consisted of delimiting the EA using the EA maps provided by the Statistical Office of Montenegro (MONSTAT). Subsequently, with the use of the maps, each household within the boundaries was visited and the number of eligible individuals (i.e. preschool children, non-pregnant women and pregnant women) in each household were noted on separate lists.

All reasonable efforts were made to recruit selected individuals for data collection. At least two repeat visits were made to the dwelling during the listing, and if no one was at home at the selected dwelling, information on the household members' whereabouts was requested from neighbours or the civic authorities to determine if the household contained any individuals eligible for participation in the survey.

Once completed, the lister attempted to recruit all preschool children and pregnant women and a sub-sample of non-pregnant women residing in the EA. If the lister could not effectively recruit or collect data on an eligible individual, the reason for this non-response was recorded on the listing form.

Once the listing was completed, the lister provided the survey coordinator with a list of households that contained eligible individuals. Subsequently, the different individuals were assigned to interviewers and the interviewers called the heads of the household or other knowledgeable household members to make appointments for the interview and blood collection. If telephone calls could not be done, actual household visits were made to schedule interviews and a phlebotomy.

2.5.5. Labelling of questionnaires and blood specimens

The laboratory testing results had to be matched with the interview data from the listed children and women. This matching was done using a unique identification number assigned to each child and woman recruited for the MONS. These identification numbers were pre-printed on labels to be applied to various forms and blood tubes. Several copies of matching labels were available to apply to all laboratory specimens from the same child or woman. This code number was entered into the electronic data collection platform more than once to minimize the chance of errors.

The laboratory technicians at the laboratory of the Primary Healthcare Centre who were responsible for centrifugation and aliquoting the blood specimens linked the unique survey IDs with their internal barcode system. To do this, the technicians manually entered the unique field label number on each vacutainer®, and then fixed and scanned a barcode to the same vacutainer®. As a second step, the laboratory of the Primary Healthcare Centre used its internal labelling system when labelling the cryovials used for the analyses that it directly conducted (i.e. CBC, HbA1c, HDL and triglycerides), and the results were linked to both their internal barcode identifiers and the unique survey IDs.

In addition, the laboratory of the Primary Healthcare Centre affixed labels containing the unique survey IDs to all cryovials that were sent to other laboratories and spare cryovials.

2.5.6. Collection of data

Tablet computers were used for direct data entry during field data collection. One questionnaire tool was developed, and this tool was able to collect all the household-level information and individual-level information (i.e. information from children and women) onto one form. This process ensured that all individuals could be linked to their respective household data, and that all children could be linked to their mother or caregiver. Skip patterns were built into the electronic system to speed up the interviewing process by automatically skipping over irrelevant questions. In addition to the electronic questionnaire, a series of supporting paper-based instruments were used to facilitate fieldwork and ensure the high quality of the fieldwork.

Verbal consent was used to collect basic information about the household. To answer household-related questions, any adult household member could serve as the respondent, although it was preferable to interview the household head or the household member with the greatest knowledge of household affairs. Those modules collected data on:

- Information about the head of the household, such as educational level;
- Water supply, household water treatment and sanitation facilities used by members of the household;
- Information about the estimated monthly household income, ownership of durable goods, land or animals, status of dwelling ownership, access to bank accounts and characteristics of the dwelling, such as the materials of the roof, walls and floors were collected in order to estimate socio-economic status.

2.5.7. Collection of individual data in the household

Prior to starting the interview questions concerning an individual woman or child, informed written consent was sought from the adult woman if she was 18 years of age or older. For children 6–59 months of age and adolescent girls 15–18 years of age, the caregiver was requested to provide written informed consent on their behalf. The questions for children and women were administered separately. For the section of the questionnaire on women, there were skip patterns to avoid posing questions about the current pregnancy to non-pregnant women. See **Appendix 8.11** for the questionnaire template that was used for the electronic data collection programme, KoboCollect.

The following data was collected on preschool children:

- Date of birth and estimated age;
- Presence of fever, diarrhoea and/or acute respiratory infection in the previous two weeks;
- Priority infant and young child feeding, as recommended by UNICEF and WHO [22], focusing on current breastfeeding, introduction of complementary foods and dietary diversity;
- Consumption of vitamin and mineral supplements in the recent past, and if the supplements were recommended by a doctor.

The following data was collected from non-pregnant women and pregnant women and recorded in the section on women in the electronic data collection form:

- Age
- Marital status
- Educational level
- Information on the highest level of school attended

- Menstruation, pregnancy or lactation status
- Minimum dietary diversity and physical activity risk factors for obesity
- Cigarette smoking (to adjust haemoglobin values)
- Consumption of vitamin and mineral supplements in the recent past, and if the supplements were recommended by a doctor.

Age and other data, as applicable, were copied from the health card, if available. For supplements, infant formulas and fortified foods, a picture catalogue was prepared. As much as possible, relevant questions were phrased as similarly as possible to the questions used in the standard Multiple Indicator Cluster Surveys (MICS) in order to take advantage of the fact that such questions have been widely tested and validated.

Upon completion of the individual modules, the interviewer manually wrote the identifying information of the participant at the start of the paper biological form. The form was then completed by the medical nurse, who recorded the blood pressure in non-pregnant and pregnant women, the waist circumference measurements (non-pregnant women only), and the estimated amount of blood collected from the women and children that had consented to providing a blood sample. The information from this paper-based form was then directly entered by the interviewers into a corresponding electronic data entry form on their tablet computers.

No substitution of non-responding individuals was done; the sample size calculations already accounted for a certain proportion of eligible individuals being unavailable or refusing participation.

2.5.8. Collection of biological data

For non-pregnant and pregnant women, the following biological information was collected on-site:

- Results of the blood pressure measurements;
- Whether blood was collected, and if so, how much;
- For non-pregnant women only: waist circumference.

For preschool children 6–59 months of age, the following biological information was collected:

- Whether blood was collected, and if so, how much.

Blood pressure was measured three times for each woman on the left arm. Blood pressure measurements were conducted while the women were sitting, and as the measurements were conducted after the interview, each woman had been sitting for 10–15 minutes prior to having her blood pressure measured. Measurements were done using a semi-automatic sphygmomanometer (Omron M3). Waist circumference was measured in a standing position, with the women wearing light clothing only (SECA 201 measurement tape, Hamburg, Germany).

2.5.9. Specimen collection and transportation

Experienced phlebotomists collected blood via venepuncture into 3-ml purple-topped tubes (i.e. Vacutainers™) coated with EDTA to prevent coagulation and 5-ml red-topped Vacutainers™ coated with a clotting agent. After blood collection, the phlebotomist gently inverted the tubes several times to ensure a homogeneous distribution of the coagulant or anticoagulant. Aseptic precautions were taken to protect the participants from any potential infection due to the phlebotomy.

Following the collection of blood samples, the Vacutainers™ were placed in a cool box containing sufficient cold packs to ensure that the whole blood samples were stored cold (at approximately 4° C) but not frozen until further processing. Cold boxes were equipped with thermometers and the health worker regularly monitored the temperature.

The Vacutainers™ were transported from the field to the laboratory of the Primary Healthcare Centre on a daily basis.

2.5.10. Transportation, processing and analysis of blood specimens

Upon receipt of the samples, the laboratory of the Primary Healthcare Centre used all the blood from the EDTA-coated Vacutainers™ to conduct a complete blood count (CBC) using a Sysmex XT4000i analyser. For this, the tubes were inverted and then processed on the complete blood counter according to the detailed manufacturer's instructions. Results were linked to the participants' survey ID and a daily back-up of the full results was made on a separate storage device. This analysis was done for all samples.

Furthermore, from the samples from NPWs and PWs, the HbA1c test was done on the samples using the Roche Cobas Pro and following the manufacturer's instruction for daily quality control.

Subsequently, the EDTA-coated Vacutainers™ and serum Vacutainers™ were centrifuged at 3,000 rpm for seven minutes to separate the plasma or serum from the erythrocytes and leukocytes. The plasma or serum was pipetted from the Vacutainers™ and aliquoted into cryovials labelled with the sample ID. These cryovials were frozen and stored at −20° C for later dispatch to local laboratories and shipment to international laboratories for biochemical analysis.

The plasma and serum samples were shipped on dry ice to international laboratories for analysis; dispatch to local laboratories was done using ice packs or dry ice, depending on the distance.

The excess plasma/serum was stored in cryovials at the at IPH in Podgorica at −80° C. These samples served as a backup in case specimens were lost or spoiled in transit. These specimens can also be used for future quality control tests and analyses.

2.5.11. Data quality assurance

Complete and accurate collection of all data was maximized by the following steps:

- Thorough training, including practice both in the classroom and in the field, was provided to all team members for all skills required during data collection.
- All interviewers were medical doctors with extensive experience in conducting public health research.
- Only medical workers experienced in venous samples from children (i.e. paediatric phlebotomists) were recruited to ensure that the medical workers had experience collecting venous blood specimens from young children; similarly, listers with pre-existing experience were given preference (e.g. MICS surveys or similar).
- Frequent supervision visits were conducted to ensure adherence to the protocol and to quality control mechanisms.
- GroundWork conducted weekly consistency checks of the data uploaded from the field. Data merges were conducted and frequency distributions for key variables were made to identify any missing information, merging issues or illogical values. Weekly monitoring reports were then shared with the survey coordinator, who liaised with the appropriate interviewer or phlebotomist to resolve any data issues.
- The cold chain was monitored with the use of thermometers that were read regularly during the fieldwork, specimen transport and temporary specimen storage. This information was collected and used as a quality control measure of sample storage in the field. Temperature checks were also conducted by the team leaders, who oversaw blood collection and storage of samples during fieldwork. Supervisors also verified documentation on the temperature ranges of the refrigerators and freezers.

2.6. Definitions of indicators and laboratory analysis

2.6.1. Waist circumference among non-pregnant women

Waist circumference was measured to the nearest half centimetre using a measuring tape placed around the survey subject's midriff midway between the iliac crest and the lower rib margin [23]. According to the International Diabetes Federation recommendations, a waist circumference equal to or above 80 cm defined central obesity [24] in non-pregnant women from a European ethnic group.

2.6.2. Hypertension in non-pregnant and pregnant women

Hypertension was defined as a systolic blood pressure equal to or above 140 mm Hg and/or a diastolic blood pressure equal to or above 90 mm Hg [25]. Blood pressure was measured three times per participant on the participant's left arm. Blood pressure measurements were collected while the participant was sitting down. As the blood pressure measurement was conducted after the interview, the participant had been sitting quietly for approximately 10–15 minutes prior to the reading. Measurements were done using a semi-automatic sphygmomanometer (Omron model M3, Omron Corporation, Kyoto, Japan).

2.6.3. Smoking status in non-pregnant and pregnant women

Smoking practices were determined by asking women if they smoked, and if so, the women were asked to report the number of cigarettes that they smoke per day or per week. Smoking intensity was used to adjust the haemoglobin concentrations in women (see Section 2.6.4 and Table 5).

In addition, smoking was examined separately with women categorized as smokers or non-smokers. No gradation of smoking status was used, as even occasional smoking – generally defined as smoking on a non-daily basis – has been associated with adverse health effects, including cancer [26], cardiovascular diseases and mortality [27].

2.6.4. Laboratory analysis

Case definitions for micronutrient markers

The cut-off values for biomarkers measured in the MONS are presented in Table 3 below. Before categorizing haemoglobin into anaemia categories, haemoglobin cut-off values were adjusted based on the altitude of residence and smoking status (women only) according to WHO recommendations (see Table 4 and Table 5).

Table 3. Clinical cut-off points and classifications for biomarker indicators

Indicators/target groups	Adequate	Mild	Moderate	Severe
Haemoglobin [28] *				
Children 6–59 months	≥ 110 g/L	100–109 g/L	70–99 g/L	<70 g/L
Non-pregnant women	≥ 120 g/L	110–119 g/L	80–109 g/L	<80 g/L
Pregnant women	≥ 110 g/L	100–109 g/L	70–99 g/L	<70 g/L
Mean corpuscular volume [29]	**Microcytic**	**Normocytic**		**Macrocytic**
Children 6–59 months	<82 fL	82–98 fL		>88 fL
Non-pregnant women	<82 fL	82–98 fL		>88 fL
Pregnant women	<82 fL	82–98 fL		>88 fL

Indicators/target groups	Cut-offs for deficiency or abnormal values
Retinol-binding protein and retinol [30]	
Children 6–59 months	<0.7 µM/L**
Non-pregnant women	<0.7 µM/L**
Plasma ferritin [31]	
Children 6–59 months	<12 µg/L**
Non-pregnant women	<15 µg/L**
Alpha-1-acid-glycoprotein [32]	
Children 6–59 months	>1 g/L
Non-pregnant women	>1 g/L
C-reactive protein [32]	
Children 6–59 months	>5 mg/L
Non-pregnant women	>5 mg/L
Folate [33]	
Non-pregnant women	<10 nmol/L (<4.4 µg/mL)
25[OH] vitamin D ¶	
Children 6–59 months	<12ng/mL (deficiency)
Non-pregnant women	≥12 to <20 ng/mL (insufficiency)
Pregnant women	
Glycated haemoglobin [34]	
Non-pregnant women	≥6.5% (diabetes)
Pregnant women	≥5.7%–6.5% (prediabetes)
	≥5.7% (elevated HbA1c)
High-density lipid protein [35]	
Non-pregnant women	>50 mg/dL
Pregnant women	
Triglycerides [36,37]	
Non-pregnant women	≥150 mg/dL (fasting) and ≥ 200 mg/dl (non-fasting)
Pregnant women	

* Because the normal haemoglobin differs according to altitude and smoking, the cut-off for defining normal haemoglobin concentrations was adjusted for these factors, see Table 4 and Table 5.

** These indicators will be adjusted for sub-clinical inflammation using appropriate algorithms [16,38]; note that for RBP, no established thresholds have been developed; however, due to a good correlation between plasma retinol and RBP, it is proposed that the same threshold be used. Further, for adult women, no thresholds exist, but in the literature, the same cut-off as for children is being used.

¶ There is no consensus cut-off point for 25[OH]D to define vitamin D deficiency. The cut-off of <50 nmol/L is used by NHANES and many other surveys.

Table 4. Adjustments in cut-off defining anaemia, by altitude of residence [39]

Altitude (metres)	Increase in cut-off point defining anaemia (g/L)
<1000	No adjustment
1000–1249	+2
1250–1749	+5
1750–2249	+8

Table 5. Adjustments in cut-off defining anaemia, by smoking status as adapted from [40]

Cigarettes smoked per day	Increase in cut-off point defining anaemia (g/L)
<10 per day	No adjustment
10–19 per day	+0.3
20–39 per day	+0.5
40+ per day	+0.7
Smoker, amount unknown	+0.3

Haemoglobin

Haemoglobin status was measured as part of a complete blood count using a Sysmex XT4000i platform by the laboratory of the Primary Healthcare Centre. In addition to haemoglobin concentration, the complete blood count also yielded mean corpuscular volume (MCV), which was used among anaemic children and women to identify the type of anaemia that was occurring (i.e. microcytic, normocytic or macrocytic). The laboratory regularly participates in an external quality control programme for full blood count (Referenzinstitut für Bioanalytik, Bonn, Germany). Daily quality control was conducted as per the manufacturer's instruction.

Glycated haemoglobin (HbA1c)

Glycated haemoglobin was measured immunoturbidimetrically using whole blood on a Roche Cobas Pro at the laboratory of the Primary Healthcare Centre. The laboratory regularly participates in an external quality control programme for HbA1c (Referenzinstitut für Bioanalytik, Bonn, Germany) and daily quality control was performed as per the manufacturer's instructions.

Serum ferritin, C-reactive protein, and alpha-1-acid glycoprotein

Ferritin is recommended by the World Health Organization for population-based assessment of iron status because it is responsive to iron interventions over time [41]. However, because ferritin levels are elevated in the presence of inflammation, the acute phase proteins alpha-1-acid-glycoprotein (AGP) and C-reactive protein (CRP) were used to identify survey subjects with inflammation. In these individuals, the ferritin values were adjusted using the correction algorithm developed by the *Biomarkers Reflecting Inflammation and Nutritional Determinants of Anemia* (BRINDA) [16,38]. The internal lowest deciles of AGP and CRP were used to calculate the difference between the inflammation markers and the decile value because they were substantially different (i.e. more than 20 per cent) from the BRINDA external reference values

[42]. Plasma ferritin, transferrin receptor, CRP and AGP were analysed using the ELISA method by the VitMin lab in Germany, which regularly participates in the CDC's VITAL-EQA quality programme.

Retinol-binding protein (RBP) and retinol

Retinol-binding protein (RBP) was used to assess the vitamin A status of all individuals in the survey. RBP can be analysed with small quantities of plasma and is highly correlated with plasma retinol [43], the biomarker of vitamin A status recommended by the World Health Organization. RBP can be elevated during acute inflammation, so the BRINDA algorithm for RBP was used to adjust RBP values based on the level of inflammation [32]. The internal lowest deciles of AGP and CRP were used to calculate the difference between inflammation markers and the decile value because they were substantially different (i.e. more than 20 per cent) from the BRINDA external reference values [42]. Unlike the adjustment for ferritin, the BRINDA project only recommends for RBP values be adjusted in children. Thus, no inflammation adjustments were made to the RBP values in non-pregnant women. Plasma RBP was analysed by the VitMin lab in Germany, which regularly participates in the CDC's VITAL-EQA quality programme.

To cross-validate the RBP measurements from the samples of preschool children and non-pregnant women, a 10 per cent sub-sample of plasma was tested for serum retinol. Serum retinol analyses were conducted by the SynLab Munich in Germany. The vitamin A deficiency cut-off values were adjusted based on the association between RBP and retinol. As shown in **Appendix 8.3**, the estimated threshold for vitamin A deficiency was <0.51863 µmol/L.

Folate

Serum folate is used to assess short-term folate status and is highly responsive to increased intakes of folate naturally present in foods and folic acid added during fortification [44]. Serum folate concentrations were measured using electro-chemoluminescence by the Alinityi Abbott analyser at the Clinical Centre of Montenegro (KCCG). The laboratory has a long-standing track-record of successful external quality control (Referenzinstitut für Bioanalytik, Bonn, Germany).

Vitamin D

Serum 25(OH) vitamin D concentrations were analysed by the KCCG. This laboratory has a proven track record of successfully participating in the external quality control programme of the Referenzinstitut für Bioanalytik, Bonn, Germany.

HDL and triglycerides

HDL and triglycerides were analysed from frozen serum samples on a Roche Cobas Pro at the laboratory of the Primary Healthcare Centre. The laboratory regularly participates in external quality control programmes for lipoproteins (Referenzinstitut für Bioanalytik, Bonn, Germany) and daily quality control was performed as per the manufacturer's instructions.

Inflammation

In addition to inflammation adjustments made to ferritin and RBP, acute phase proteins were used to categorize the various inflammation stages of individuals. Concentrations of CRP >5 mg/L and AGP >1 g/L denote acute and chronic inflammation, respectively. Using the approach developed by Thurnham [32], each individual was assigned to one of the following four inflammation categories: no inflammation; incubation (elevated CRP only); early convalescence (elevated CRP and AGP); and late convalescence (elevated AGP only). These categories illustrated the various stages of inflammation that can occur. In addition, "any inflammation", defined as elevated CRP and/or elevated AGP, was used for sub-group analyses to illustrate the potential risk factors of anaemia and other indicators.

2.7. Data management and analysis

2.7.1. Data analysis

Data analysis was done using STATA version 17. In general, data analysis included calculation of proportions to derive the prevalence of nutrition and health outcomes, and the calculation of means and medians as measures of central tendency for continuous measurements. Nationwide prevalence rates were calculated using weighted analysis for children, non-pregnant women and pregnant women to account for the unequal probability of selection in the three strata. Household-level analyses were not weighted. The statistical precision of all estimates was assessed using 95 per cent confidence limits. All measures of precision, including confidence limits and chi-squared p-values for differences, were calculated accounting for the complex cluster and stratified sampling used by the MONS.

For preschool children and non-pregnant women, descriptive statistics were calculated across all strata, for each stratum separately, and by sex (for children only). The results are presented by specific age sub-group for non-pregnant women and children. For example, results are presented for children 6–11 months, 12–23 months, 24–35 months, 36–47 months and 48–59 months of age. The age sub-groups for non-pregnant women are 15–19 years, 20–29 years, 30–39 years and 40–49 years. For pregnant women, only national estimates by age group and some demographic characteristics were generated because of the small sample size.

2.7.2. Calculation of composite variables

Wealth index: Using data on each household's monthly income and ownership of durable goods, a wealth index was calculated using the World Bank method [45]. Calculation of wealth index quintiles categorized the continuous wealth index and permitted cross-tabulation and the subsequent presentation of the key indicators by wealth.

Clean/solid fuel: Solid fuels include: coal/lignite, charcoal, wood, straw/shrub/grass, agricultural crops and animal dung. Clean fuels include: electricity, liquefied petroleum gas (LPG), natural gas and biogas [46].

Minimum dietary diversity: For women, minimum dietary diversity was calculated using the FANTA MDD-W method [47]. For the calculation of minimum dietary diversity for children 6–

23 months of age, the 2021 WHO/UNICEF guidelines on indicators for assessing infant and young child feeding (IYCF) practices were used, which define minimum diversity as consuming foods and beverages from at least five out of the eight defined food groups (including breastmilk) during the previous day [48]. Of note, some IYCF indicators, such as early initiation of breastfeeding, are recommended by the WHO to be measured in children 0–23 months of age [48]. However, as the MONS did not include children younger than 6 months, these indicators were calculated for children 6–23 months of age.

Sun exposure index: As the quantity of vitamin D synthesized by the body is related to sun exposure, the average sun exposure that women and children were subjected to on a daily basis was estimated as the number of hours spent outside daily, while accounting for the frequency of use of sun protection and sunscreen, based on an approach developed by Gannage-Yared et al. [49]. The number of minutes of sun exposure was multiplied by the following factors depending on the frequency of use of sun protection and sunscreen:

Consistency	Multiplication factor
Never/rarely	1.0
Sometimes	0.8
Most of the time	0.2
Always	0

The index was then multiplied by the percentage of the body exposed to sunlight (9 per cent for the head, 1 per cent for each hand, and 9 per cent for each arm).

Working activity: As part of the women's section of the questionnaire, women were asked if they had done any paid work outside the home in the previous seven days. If the respondent reported "yes", a follow-up question about the type of work was asked, and the respondent was asked to classify their job as unskilled labour, skilled labour or their own business. Due to the small number of women reporting that they owned their own business, the categories ultimately used are as follows: no paid work; unskilled labour; and skilled labour/own business.

Metabolic syndrome: According to the International Diabetes Federation [50], there are five independent indicators that are used to assess metabolic syndrome: central/visceral obesity measured by waist circumference; elevated serum triglycerides; elevated glucose; hypertension; and low HDL cholesterol. The presence of three or more of the aforementioned conditions constitutes a clinical diagnosis of metabolic syndrome. While the measure of glucose cited by the International Diabetes Federation was fasting plasma glucose, the MONS utilized HbA1c, as this measure is a more long-term measure of diabetes and insulin resistance, and since the measurement of HbA1c would not require participants to fast prior to providing a blood sample, which would have been impractical for a national cross-sectional survey such as the MONS. Moreover, HbA1c is one of the biomarkers recommended by the WHO to diagnose diabetes mellitus [34].

Metabolic syndrome was not measured in pregnant women, as the measurement of central/ visceral obesity cannot be used as a cardiometabolic risk factor during pregnancy.

3. RESULTS

3.1. Study participation of children, non-pregnant women and pregnant women

Figure 2 summarizes the number of respondents and response rates at the different stages of the survey. Eligible individuals from the three target groups (preschool children, non-pregnant women and pregnant women) were found in 1384 households.

Nationally, the MONS identified 861 eligible children 6–59 months. Complete interview data is available for 54 per cent of children. A sizable number of caregivers refused to let a blood sample be taken from their children, and thus, blood sample data is only available for 41 per cent of the eligible children.

In total, 2368 non-pregnant women 15–49 years of age were eligible to participate in the MONS. Of these women, 69 per cent completed the interview data, cardiometabolic assessment data and blood sample data. The vast majority of the women that consented to participate in the survey provided all the requested data.

The MONS identified 86 pregnant women, of whom 76 per cent completed the interview. Only one of the consenting pregnant women did not provide a blood sample, and a 74 per cent response rate for the cardiometabolic assessment data and blood sample data was yielded.

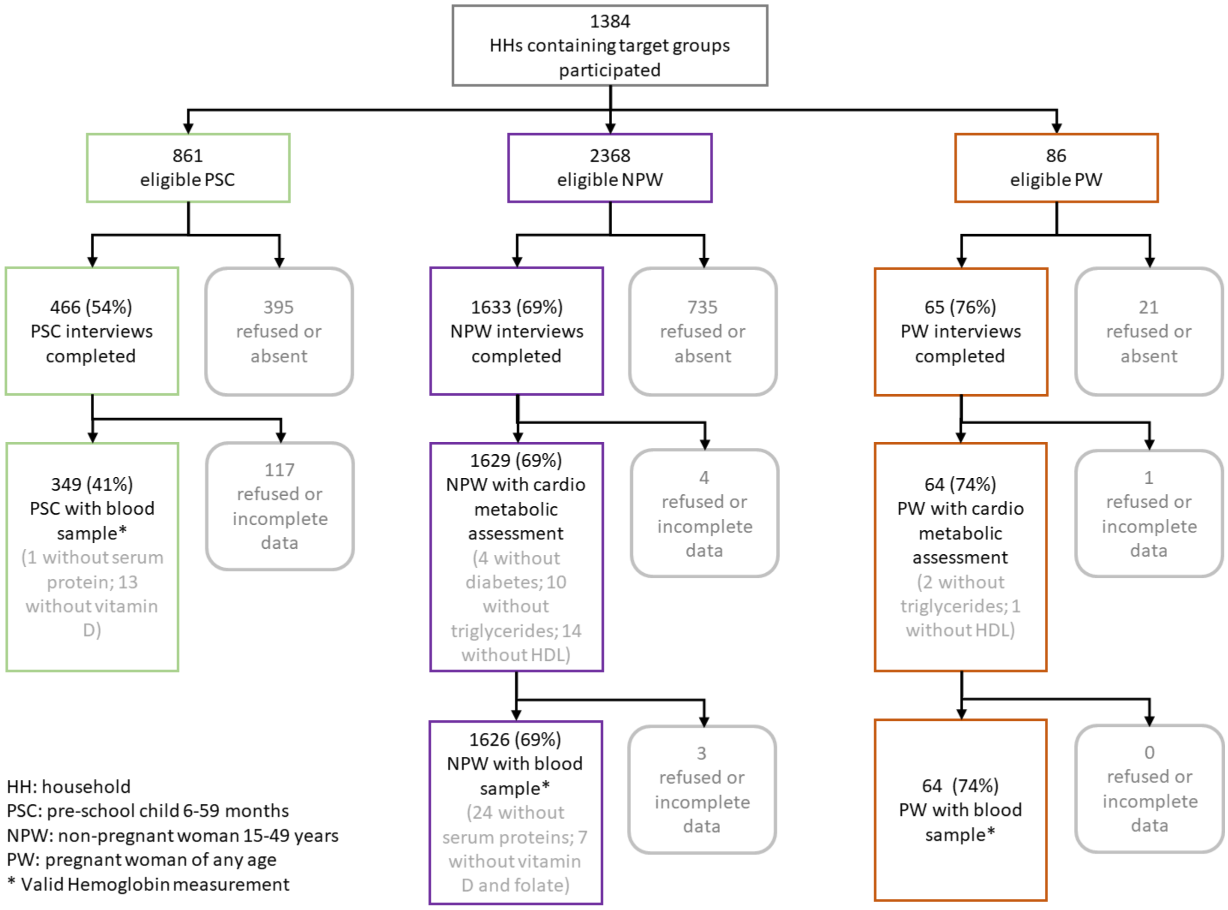

Figure 2. Participation flow diagram for children and women, Montenegro 2022

3.2. Household characteristics

3.2.1. Characteristics

Table 6 presents the general characteristics of the 1384 households from which children and/or women were selected. Nearly 60 per cent of the households were in urban areas, and more than 40 per cent of the households were located in the central region. Although the MONS did not randomly select households, but rather selected children and women, the distribution of the households of the MONS was similar to Montenegro's 2011 census [17], which served as the sampling frame for the MONS. The households included in the MONS were equally allocated to the wealth quintiles, but no comparable results were available from the 2011 census.

Table 6. Characteristics of households that contain recruited children and/or women, Montenegro 2022

Characteristic	N	%	% in 2011 census
Residence			
Urban	818	59.1	65.3%
Rural	566	40.9	34.7%
Region			
South	455	32.9	25.9%
Centre	605	43.7	46.6%
North	324	23.4	27.5%
Wealth quintile			
Lowest	277	20.0	--
Second	277	20.0	--
Middle	277	20.0	--
Fourth	278	20.1	--
Highest	275	19.9	--
TOTAL	1384	100.0	--

Note: The N numbers are the numerators for a specific sub-group.

Households included in the MONS contained 4.3 members on average (Table 7). Nearly 85 per cent of the households contained between 3 and 6 household members. In households with children, most children aged 6–59 months were the only child in this age group in the household. Approximately two thirds of households with women contained only one non-pregnant woman 15–49 years old, and pregnant women were found in less than 5 per cent of households.

Table 7. Household composition of households that contain recruited children and/or women, Montenegro 2022

Characteristic	N	% or mean	[95% CI] [a]
Average household size			
Mean	1384	4.3	[4.2, 4.4]
Number of household (HH) members			
1	29	2.1	[1.3, 3.3]
2	97	7.0	[5.7, 8.6]
3	231	16.7	[14.6, 19.0]
4	459	33.2	[30.6, 35.8]
5	329	23.8	[21.2, 26.6]
6	150	10.8	[9.2, 12.7]
7	58	4.2	[3.2, 5.5]
8+	31	2.2	[1.5, 3.3]
Proportion of HHs with given number of children 6–59 months of age			
0	1000	72.3	[69.5, 74.9]
1	280	20.2	[18.1, 22.6]
2	95	6.9	[5.5, 8.5]
3	8	0.6	[0.3, 1.1]
4	0	-	-
5	1	0.1	[0.0, 0.5]
Proportion of HHs with given number of women 15–49 years of age			
0	65	4.7	[3.7, 6.0]
1	1060	76.6	[73.4, 79.5]
2	197	14.2	[12.2, 16.5]
3	58	4.2	[3.2, 5.5]
4	4	0.3	[0.1, 0.8]
Proportion of HHs with given number of pregnant women			
0	1318	95.2	[93.9, 96.3]
1	66	4.8	[3.7, 6.1]
TOTAL	1384	100	

Note: The N numbers are the numerators for a specific sub-group.

[a] CI = confidence interval was calculated taking into account the complex sampling design.

As shown in Table 8, more than 90 per cent of households had at least one household member who was employed or earning income, and nearly half of the households had two employed household members. Nearly 90 per cent of households had a bank account, and approximately 40 per cent reported making financial transactions with a mobile telephone.

Regarding household income in the past month, nearly 7 per cent of the households reported having no income in the past month, and about 11 per cent reported a monthly income of between €250 and €500. For monthly incomes above €500, similar proportions (i.e. 11–17%) were reported for each €250 income group. Importantly, nearly 16 per cent of households refused to answer this question.

Table 8. Employment, income, and financial access variables among households that contain recruited children and/or women, Montenegro 2022

Characteristic	N	%	[95% CI] [a]
Household member is employed or earning income			
No	106	7.7	[5.8, 10.0]
Yes	1278	92.3	[90.0, 94.2]
Number of household members employed or earning income			
0	106	7.7	[5.8, 10.0]
1	445	32.2	[29.6, 34.9]
2	663	47.9	[44.7, 51.1]
3+	170	12.3	[10.4, 14.5]
Household income in the past month			
No income in the past month	93	6.7	[5.0, 9.0]
Under €250	30	2.2	[1.4, 3.3]
From €251 to €500	126	9.1	[7.4, 11.1]
From €501 to €750	186	13.4	[11.4, 15.8]
From €751 to €1000	239	17.3	[14.8, 20.1]
From €1001 to €1250	175	12.6	[10.4, 15.3]
From €1251 to €1500	166	12.0	[9.8, 14.7]
Above €1500	153	11.1	[8.7, 14.0]
Refused to answer	216	15.6	[11.2, 21.3]
Member of the household has a bank account			
No	180	13.0	[10.4, 16.1]
Yes	1204	87.0	[83.9, 89.6]
Member of the household uses a mobile telephone to make financial transactions			
No	807	58.3	[53.1, 63.3]
Yes	577	41.7	[36.7, 46.9]

Note: The N numbers are the numerators for a specific sub-group.

[a] CI = confidence interval was calculated taking into account the complex sampling design.

3.2.2. Cooking and heating fuel

As shown in Table 9, at the national level, more than 80 per cent of surveyed households reported using a "clean fuel" (i.e. electricity, liquefied petroleum gas (LPG), natural gas and biogas) for cooking. Substantial differences were found at the regional level, with "clean" cooking fuel used by approximately 95 per cent of households in the central and southern regions, but only 46 per cent of households in the northern region.

Regarding heating fuel, at the national level, only about 31 per cent of households used "clean" fuels to heat their homes (Table 9). Regional differences were also found for heating fuel, with 1 per cent, 24 per cent and 64 per cent of households using "clean" heating fuels in the northern, central and southern regions, respectively.

3.2.3. Land and livestock ownership

As shown in Table 10, approximately 30 per cent and 20 per cent of households owned agricultural land and grazing land, respectively. Among the households that owned agricultural or grazing land, the average size of the grazing land (30 hectares) was nearly double the size of agricultural land (18 hectares). Approximately 20 per cent of households owned some livestock, and of those households, chickens, cattle and pigs were the most commonly owned animals.

Table 9. Type of energy used for cooking and heating in households that contain recruited children and/or women, Montenegro 2022

Characteristic	N	%	[95% CI] [a]
Type of fuel or energy used for cooking [b]			
Clean fuel	1151	83.2	[78.6, 86.9]
Solid fuel	233	16.8	[13.1, 21.4]
No food cooked in household/other/don’t know	0	-	
Type of fuel or energy used to heat the house [b]			
Clean fuel	435	31.4	[25.4, 38.2]
Solid fuel	947	68.4	[61.7, 74.5]
No heating in household/other/don’t know	2	0.1	[0.0, 0.6]

Note: The N numbers are the numerators for a specific sub-group.
[a] CI = confidence interval, calculated taking into account the complex sampling design.
[b] Clean fuels include electricity, liquefied petroleum gas (LPG), natural gas and biogas. Solid fuels include coal/lignite, charcoal and wood.

Table 10. Agricultural land and livestock of households that contain recruited children and/or women, Montenegro 2022

Characteristic	N	% or mean	[95% CI] [a]
Member of household owns any agricultural land			
No	925	66.8	[61.3, 71.9]
Yes	459	33.2	[28.1, 38.7]
Average size of agricultural land			
Mean (hectares)	459	18.3	[8.4, 28.1]
Member of household owns any grazing land			
No	1121	81.0	[76.7, 84.6]
Yes	263	19.0	[15.4, 23.3]
Average size of grazing land			
Mean (hectares)	263	30.6	[14.4, 46.8]
Household owns any livestock			
No	1092	78.9	[73.7, 83.3]
Yes	292	21.1	[16.7, 26.3]
Household owns livestock, specific [b]			
Cattle	152	52.1	[42.5, 61.5]
Horses, donkeys, mules	18	6.2	[3.7, 10.1]
Goats	38	13.0	[9.5, 17.6]
Sheep	34	11.6	[7.7, 17.2]
Pigs	146	50.0	[40.2, 59.8]
Chicken	199	68.2	[61.5, 74.1]
Other poultry	16	5.5	[3.4, 8.7]

Note: The N numbers are the numerators for a specific sub-group.
[a] CI = confidence interval calculated taking into account the complex sampling design.
[b] Question only asked to households responding “Yes” to livestock ownership.

3.3. Children 6–59 months of age

3.3.1. Demographic characteristics

Table 11 presents the demographic characteristics of children 6–59 months of age participating in the MONS. These results show that the regional distribution of the MONS survey population is similar to the actual Montenegrin population based on the 2011 census data. However, the MONS contained a smaller proportion of children from urban areas than the 2011 census.

Table 11. Description of children 6–59 months of age, Montenegro 2022

Characteristic	N	% [a]	[95% CI] [b]	% in 2011 census
Age group (in months)				
6–11	44	9.3	[6.8, 12.6]	--
12–23	101	21.7	[17.9, 25.9]	--
24–35	120	25.7	[22.1, 29.6]	--
36–47	87	18.8	[15.5, 22.6]	--
48–59	114	24.6	[21.2, 28.4]	--
Sex				
Male	245	52.6	[47.9, 57.2]	--
Female	221	47.4	[42.8, 52.1]	--
Residence				
Urban	268	57.4	[46.0, 68.0]	64.9
Rural	198	42.6	[32.0, 54.0]	35.1
Region				
South	124	26.6	[20.3, 34.0]	23.0
Centre	228	48.9	[41.6, 56.3]	48.9
North	114	24.5	[19.9, 29.6]	28.0
Wealth quintile				
Lowest	107	25.1	[19.7, 31.4]	--
Second	88	19.1	[14.5, 24.8]	--
Middle	76	16.0	[12.2, 20.7]	--
Fourth	104	21.5	[16.8, 27.2]	--
Highest	91	18.3	[13.6, 24.0]	--
TOTAL	466	100.0		

Note: The N numbers are the numerators for a specific sub-group.

[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.

[b] CI = confidence interval calculated taking into account the complex sampling design

3.3.2. Recent illness and health indicators

Table 12 presents the key birthweight and illness indicators. Regarding birthweight, nearly all children participating in the survey had been weighed at birth, and the majority of birthweights were provided by recall, with fewer than 5 per cent of the respondents displaying a hospital record or discharge report. Mean birthweight is approximately 900 grams higher than the threshold for low birthweight (i.e. <2500 grams) and few children 6–59 months of age are classified as low birthweight. Regarding illness, the MONS found that the proportion of children with acute lower respiratory infection or diarrhoea two weeks prior to the survey is very low, but nearly 20 per cent of caregivers reported that their child had had a fever in the two weeks prior to the interview.

Table 12. Health indicators in children 6–59 months of age, Montenegro 2022

Characteristic	N	% or mean [a]	[95% CI] [b]
Child weighed at birth			
No	0	0	[0, 0]
Yes	455	97.6	[95.1, 98.8]
Don't know	11	2.4	[1.2, 4.9]
Birthweight in kilograms (mean kg) [c]	455	3.38	[3.33, 3.44]
Low birthweight [c]			
<2500 grams	21	4.5	[2.8, 7.2]
≥2500 grams	434	95.5	[92.8, 97.2]
Source of the child's birthweight [c]			
Hospital discharge report or certificate	20	4.5	[2.3, 8.5]
Recall	435	95.5	[91.5, 97.7]
Had a lower acute respiratory infection in the previous two weeks [d]			
No	461	99.0	[97.7, 99.6]
Yes	5	1.0	[0.4, 2.3]
Don't know	0	-	-
Had diarrhoea in the previous two weeks			
No	445	95.5	[92.8, 97.2]
Yes	21	4.5	[2.8, 7.2]
Don't know	0	-	-
Had a fever in the previous two weeks			
No	379	81.4	[77.2, 84.9]
Yes	87	18.6	[15.1, 22.8]
Don't know	0	-	-

Note: The N numbers are the numerators for a specific sub-group.
[a] Percentages and means weighted for unequal probability of selection among regions.
[b] CI = confidence interval calculated taking into account the complex sampling design.
[c] Only includes those children weighed at birth.
[d] Questions on recent illness were phrased according to the MICS manual [51].

3.3.3. Inflammation

As shown in Table 13, approximately 36 per cent of children have any inflammation, and no demographic factors are significantly associated with inflammation. Convalescent inflammation (normal CRP, high AGP) is the most common, affecting nearly one quarter of the children participating in the MONS (Figure 3).

Table 13. Inflammation in children 6–59 months of age, by various demographic characteristics, Montenegro 2022

Characteristic	N	% with any inflammation [a, b]	[95% CI] [c]	p-value [d]
Age group (in months)				0.669
6–11	26	35.2	[17.2, 58.5]	
12–23	68	44.2	[31.0, 58.2]	
24–35	97	35.6	[26.6, 45.8]	
36–47	66	34.2	[24.6, 45.2]	
48–59	91	32.7	[24.1, 42.7]	
Low birth weight				0.748
Yes	15	32.6	[13.8, 59.4]	
No	326	36.8	[31.2, 42.9]	
Sex				0.595
Male	181	34.6	[26.3, 44.0]	
Female	167	37.9	[30.5, 45.8]	
Residence				0.748
Urban	198	35.4	[28.9, 42.5]	
Rural	150	37.2	[28.5, 46.8]	
Region				0.920
South	88	35.2	[25.7, 46.1]	
Centre	174	37.4	[29.9, 45.4]	
North	86	34.9	[23.6, 48.2]	
Wealth quintile				0.705
Lowest	88	38.0	[25.8, 52.0]	
Second	71	32.7	[23.9, 42.9]	
Middle	62	40.3	[29.5, 52.1]	
Fourth	66	29.9	[19.7, 42.6]	
Highest	61	39.9	[26.4, 55.2]	
TOTAL	348	36.2	[30.6, 42.1]	

Note: The N numbers are the denominators for a specific sub-group. Sub-groups that do not sum to the total have missing data.

[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.

[b] Any inflammation defined as elevated CRP (>5 mg/L) and/or elevated AGP (>1 g/L)

[c] CI = confidence interval calculated taking into account the complex sampling design.

[d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.

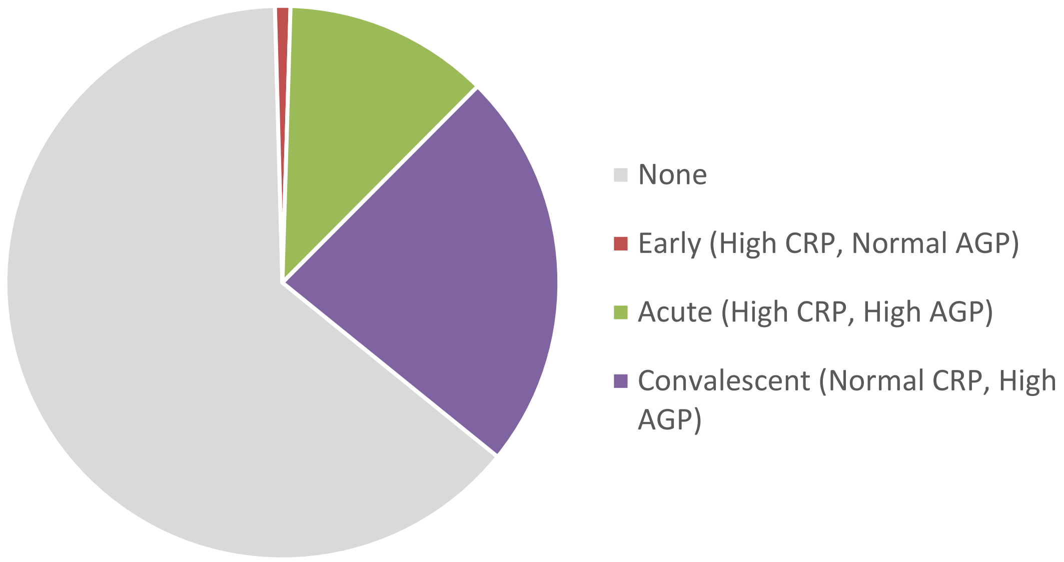

Figure 3. Inflammation categories in children 6–59 months of age, Montenegro 2022

3.3.4. Infant and young child feeding indicators

Table 14 presents several of the standard infant and young child feeding indicators recommended by the WHO and UNICEF [52]. More than 75 per cent of the surveyed children 6–23 months of age had ever been breastfed. Approximately 45 per cent of children were breastfed immediately after birth, about 55 per cent of children were exclusively breastfed for the first two days after birth. Continued breastfeeding was reported in nearly 22 per cent of children 12–23 months of age.

The complementary feeding indicators generally show a positive situation, with nearly 95 per cent of children 6–8 months of age receiving complementary foods. Among non-breastfed children 6–23 months of age, nearly 77 per cent of children receive the minimum number of milk feedings for their age. Among the same age group, approximately 75 per cent and 87 per cent of children 6–23 months of age achieve the minimum dietary diversity and minimum meal frequency (MMF), respectively.

In contrast, the minimum acceptable diet – a composite of minimum dietary diversity and minimum meal frequency – was only found in 58 per cent of children. This relatively low proportion is due to that fact that about one quarter of children that have the minimum meal frequency *do not* have the minimum dietary diversity (data not shown).

Table 14. IYCF indicators in children 6–23 months of age (unless stated otherwise), Montenegro 2022

Characteristic	N	% [a]	[95% CI][b]
Ever breastfed (Indicator #1)			
No	31	20.8	[14.5, 28.9]
Yes	109	75.5	[67.1, 82.4]
Don't know	5	3.7	[1.6, 8.3]
Early initiation of breastfeeding (Indicator #2)			
No	75	50.3	[40.9, 59.6]
Yes	64	45.4	[35.8, 55.3]
Don't know	6	4.4	[2.1, 9.1]
Exclusively breastfed for the first two days after birth (Indicator #3)			
No	53	36	[28.0, 44.8]
Yes	80	55.4	[46.4, 64.1]
Don't know	12	8.6	[5.1, 14.3]
Continued breastfeeding at 1 year (12–23 months of age; Indicator #6)			
No	79	78.2	[68.3, 85.6]
Yes	22	21.8	[14.4, 31.7]
Don't know	0	-	-
Introduction of solid foods (6–8 months; Indicator #7)			
No	1	5.3	[0.7, 30.1]
Yes	21	94.7	[69.9, 99.3]
Don't know	0	-	-
Minimum dietary diversity (Indicator #8)			
No	34	23.8	[17.4, 31.8]
Yes	109	74.7	[66.6, 81.4]
Don't know	2	1.5	[0.4, 5.8]
Minimum meal frequency (Indicator #9)			
No	9	6.7	[3.0, 14.0]
Yes	127	87.3	[79.5, 92.4]
Don't know	9	6.1	[2.9, 12.3]
Minimum milk feeding frequency for non-breastfed children (Indicator #10) [c]			
No	10	9.0	[4.8, 16.4]
Yes	87	76.8	[66.8, 84.6]
Don't know	16	14.1	[8.5, 22.6]
Minimum acceptable diet (Indicator #11)			
No	35	24.9	[17.8, 33.7]
Yes	85	58.0	[48.9, 66.6]
Don't know	25	17.1	[11.3, 24.9]
Egg and/or flesh food consumption (Indicator #12)			
No	14	9.4	[5.5, 15.8]
Yes	129	89.1	[82.1, 93.5]
Don't know	2	1.5	[0.4, 5.8]
Sweet beverage consumption (Indicator #13)			
No	73	49.4	[40.0, 58.7]
Yes	72	50.6	[41.3, 60.0]
Don't know	0	-	-

Table continued on next page

Characteristic	N	% [a]	[95% CI][b]
Zero vegetable or fruit consumption (Indicator #15)			
Zero vegetable or fruits	8	5.9	[2.9,11.3]
Any vegetable or fruits	135	92.7	[86.3,96.2]
Don't know	2	1.5	[0.4,5.8]
Bottle-fed in previous 24 hours (Indicator #16)			
No	33	22.8	[15.7,31.9]
Yes	107	73.5	[64.1,81.2]
Don't know	5	3.7	[1.6,8.3]

Note: The N numbers are the numerators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] CI = confidence interval calculated taking into account the complex sampling design.

[c] Only includes non-breastfed children at time of survey (N=113).

3.3.5. Dietary diversity, meal frequency and acceptable diet in children 6–23 months of age

Table 15 presents the results of minimum dietary diversity, meal frequency and acceptable diet in children 6–23 months of age by various demographic indicators. The "don't know" responses were excluded from this analysis, and thus, the totals displayed for each indicator do not match the results presented above in Table 14.

When excluding the "don't know" response option, approximately 76 per cent of children 6–23 months of age have the minimum diverse diet, and more than 90 per cent have a diet with the minimum meal frequency. The minimum acceptable diet – a composite of both minimum dietary diversity and meal frequency – is found in about 70 per cent of children.

No significant associations were found between minimum dietary diversity and the various demographic indicators. Minimum meal frequency is significantly associated with wealth quintile, with a significant lower proportion of the children residing in the lowest wealth quintile households achieving minimum meal frequency compared to children in the higher quintiles. Minimum meal frequency was also significantly associated with region, with the lowest proportion of children achieving the desired frequency in the northern region. Minimum acceptable diet is also associated with wealth quintile, and a dose-response relationship is observed where the prevalence of children with the minimum acceptable diet increases as the wealth quintile increases.

Table 15. Minimum dietary diversity, minimum meal frequency and minimum acceptable diet in children 6–23 months of age, by various demographic characteristics, Montenegro 2022

	Minimum dietary diversity [d]				Minimum meal frequency [e]				Minimum acceptable diet [f]			
Characteristic	**N**	**% [a]**	**[95% CI] [b]**	**p-value [c]**	**N**	**% [a]**	**[95% CI] [b]**	**p-value [c]**	**N**	**% [a]**	**[95% CI] [b]**	**p-value [c]**
Age group (in months)				0.660				0.342				0.905
6–11	43	71.1	[56.0, 82.6]		43	97.3	[82.2, 99.6]		42	67.6	[52.4, 79.8]	
12–17	51	78.4	[65.3, 87.5]		48	93.4	[74.9, 98.5]		43	71.6	[55.8, 83.5]	
18–23	49	77.2	[63.6, 86.8]		45	88.3	[73.6, 95.3]		35	70.6	[53.4, 83.5]	
Low birth weight				0.588				0.075				0.650
Yes	9	68.3	[34.0, 90.0]		8	75.9	[37.4, 94.3]		5	61.7	[20.1, 91.2]	
No	131	76.5	[67.9, 83.4]		125	93.8	[85.3, 97.5]		112	71.3	[61.1, 79.7]	
Sex				0.090				0.672				0.153
Male	74	70.1	[58.3, 79.7]		69	92.0	[79.8, 97.1]		61	63.4	[48.5, 76.1]	
Female	69	82.2	[71.4, 89.5]		67	93.9	[84.5, 97.7]		59	77.0	[63.5, 86.5]	
Residence				0.840				0.723				0.960
Urban	81	75.1	[65.2, 83.0]		79	92.0	[81.6, 96.8]		71	69.8	[56.2, 80.6]	
Rural	62	76.7	[62.3, 86.8]		57	94.2	[76.8, 98.7]		49	70.2	[54.3, 82.4]	
Region				0.511				0.037				0.125
South	38	81.6	[65.2, 91.3]		33	97.0	[82.1, 99.6]		31	80.6	[61.5, 91.6]	
Centre	76	76.3	[65.3, 84.6]		76	96.1	[88.4, 98.7]		63	73.0	[60.1, 82.9]	
North	29	69	[48.8, 83.8]		27	81.5	[54.3, 94.2]		26	53.8	[31.1, 75.1]	
Wealth quintile				0.107				0.011				0.005
Lowest	28	61.1	[42.0, 77.3]		27	77.1	[51.3, 91.5]		25	43.7	[24.5, 65.0]	
Second	21	65.3	[44.3, 81.7]		21	95.3	[73.7, 99.3]		19	61.8	[39.3, 80.1]	
Middle	25	84.5	[63.6, 94.5]		22	95.3	[73.8, 99.3]		19	79.5	[55.2, 92.4]	
Fourth	34	82.5	[64.7, 92.4]		33	100			30	80.3	[62.8, 90.8]	
Highest	35	83.2	[67.1, 92.4]		33	97.2	[82.1, 99.6]		27	85.6	[66.7, 94.6]	
TOTAL	143	75.8	[67.7, 82.4]		136	92.9	[85.2, 96.8]		120	70.0	[60.0, 78.3]	

Note: The N numbers are the denominators for a specific sub-group and exclude the "don't know" response option. Thus, the proportions reported in this table vary slightly from those reported in Table 14. Sub-groups that do not sum to the total have missing data.
[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions. // [b] CI = confidence interval calculated taking into account the complex sampling design.
[c] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others. // [d] Minimum dietary diversity indicates that more than five food groups were consumed.
[e] Minimum meal frequency indicates that more than two feedings of solid, semi-solid or soft foods were consumed for breastfed infants aged 6–8 months; more than three feedings of solid, semi-solid or soft foods were consumed for breastfed children aged 9–23 months; and more than four feedings of solid, semi-solid or soft foods or milk feeds were consumed for non-breastfed children aged 6–23 months whereby at least one of the four feeds must be a solid, semi-solid or soft feed. // [f] Minimum acceptable diet indicates that breastfed children received at least the minimum dietary diversity and minimum meal frequency for their age during the previous day; that non-breastfed children received at least the minimum dietary diversity and minimum meal frequency for their age during the previous day, as well as at least two milk feeds.

3.3.6. Consumption of vitamins, minerals, supplements and fortified foods

As shown in Table 16, few children 6–59 months of age consume fortified baby cereal or infant formula with added iron. Iron and vitamin A supplements are rarely consumed, but multivitamin supplements are consumed by more than 15 per cent of children. Respondents were also asked if their child had consumed medicine to prevent/treat intestinal parasites in the past six months, and the consumption of such a medicine was found in no children (data not shown).

Table 16. Consumption of iron-fortified food, vitamin supplements in children 6–59 months of age, Montenegro 2022

Characteristic	N	% [a]	[95% CI] [b]
Consumed commercially fortified baby cereal			
No	417	90.9	[88.0, 93.1]
Yes	41	8.9	[6.8, 11.6]
Don't know	1	0.2	[0.0, 1.8]
Consumed infant formula with added iron			
No	442	96.3	[94.0, 97.8]
Yes	16	3.4	[2.0, 5.8]
Don't know	1	0.2	[0.0, 1.6]
Took iron tablet or syrup in previous six months			
No	447	97.4	[94.9, 98.7]
Yes	12	2.6	[1.3, 5.1]
Don't know	0	-	-
Took multivitamin supplement in previous six months			
No	382	83.5	[78.2, 87.7]
Yes	76	16.3	[12.1, 21.5]
Don't know	1	0.2	[0.0, 1.6]
Took vitamin A supplements in previous six months			
No	450	98.1	[96.2, 99.0]
Yes	9	1.9	[1.0, 3.8]
Don't know	0	-	-

Note: The N numbers are the numerators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection among regions.
[b] CI = confidence interval calculated taking into account the complex sampling design.

3.3.7. Sun exposure

Table 17 shows the indicators of sun exposure in children 6–59 months of age. More than 50 per cent of children protect their heads from the sun when outside. In contrast, most children do not protect their arms and hands from the sun when outdoors. More than 90 per cent of children spend more than one hour outside on a typical day, and more than 50 per cent of children spend two or more hours outside. Sunscreen is used either "sometimes" or "most of the time" with approximately 40 per cent of children. Based on the time spent outdoors and the dressing and sunscreen practices, approximately two thirds of children are in the highest sun index category.

Table 17. Sun exposure patterns in children 6–59 months of age, Montenegro 2022

Characteristic	N	% [a]	[95% CI] [b]
Usually protects head from sun when outside			
Never/rarely	217	48.3	[39.9, 56.7]
Sometimes	139	30.2	[24.5, 36.5]
Most of the time	79	16.6	[12.7, 21.4]
All the time	24	4.9	[2.9, 8.2]
Usually covers arms when outside			
Never/rarely	411	89.4	[83.8, 93.3]
Sometimes	39	8.6	[5.2, 13.7]
Most of the time	9	2.0	[1.0, 4.2]
All the time	0	-	-
Usually covers hands when outside			
Never/rarely	437	95.3	[92.3, 97.1]
Sometimes	18	3.9	[2.4, 6.1]
Most of the time	4	0.9	[0.2, 3.3]
All the time	0	-	-
Approximate daily time spent under the sun			
None	0	-	-
1–59 minutes	19	4.5	[2.7, 7.5]
1–2 hours	122	27.2	[22.1, 33.0]
2–3 hours	185	39.6	[34.5, 44.9]
>3 hours	133	28.7	[22.9, 35.3]
Usually uses sunscreen			
Never/rarely	253	56.9	[48.6, 64.7]
Sometimes	142	30.1	[24.4, 36.4]
Most of the time	52	10.6	[7.0, 15.8]
All the time	12	2.4	[1.4, 4.3]
Child's skin colour			
Very white	30	6.7	[4.2, 10.5]
White	224	48.9	[41.5, 56.3]
Olive	170	37.3	[29.3, 46.0]
Dark	34	7.0	[4.4, 10.8]
Very dark	1	0.2	[0.0, 1.5]
Sun exposure index			
20+	310	67.4	[59.8, 74.2]
10–19.9	72	16.3	[12.3, 21.2]
0.01–9.9	65	13.8	[9.6, 19.5]
0	12	2.4	[1.4, 4.3]

Note: The N numbers are the numerators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] CI = confidence interval calculated taking into account the complex sampling design.

3.3.8. Anaemia, iron deficiency and iron deficiency anaemia

Valid haemoglobin measurements were available for 349 children 6–59 months of age. The mean and median haemoglobin concentrations are 119.6 g/L (95% CI: 118.5, 120.7; standard error = 0.5706) and 120 g/L (IQR: 114, 126), respectively (Figure 4).

Figure 5 visualizes the proportion of children with anaemia, iron deficiency and concomitant iron deficiency and anaemia, often referred to as iron deficiency anaemia. Anaemia is present in approximately 13 per cent of children, denoting a “mild” public health problem according to the WHO classification [28]. Iron deficiency is present in about 40 per cent of children. The prevalence of iron deficiency anaemia is 9.3 per cent and among anaemic children, 70.5 per cent are deficient in iron (data not shown).

The prevalence of anaemia, iron deficiency and iron deficiency anaemia by various demographic factors is presented in Table 18. The prevalence of anaemia, iron deficiency and iron deficiency anaemia is significantly associated with age, with the highest prevalences of each condition occurring in the 12–23 months of age sub-group. For anaemia, the prevalence in children 12–23 months of age is approximately 30 per cent, denoting a “moderate” public health problem according to the WHO [28]. In this same age group, approximately 68 per cent and 25 per cent of children are deficient in iron and have iron deficiency anaemia, respectively.

Among anaemic children (i.e. Hb <110 adjusted for altitude), Figure 6 displays — by age group — the type of anaemia observed based on MCV, an indicator of the average size of red blood cells. Nearly 90 per cent of anaemic children 6–59 months of age display microcytosis, a condition caused by iron deficiency or the genetic blood disorder thalassemia. Approximately 90–100 per cent of anaemic children are microcytic in all the age groups except the 36–47-month group where only 65 per cent of children are microcytic. The remaining anaemic children are normocytic; no anaemic children have MCV values that indicate macrocytosis.

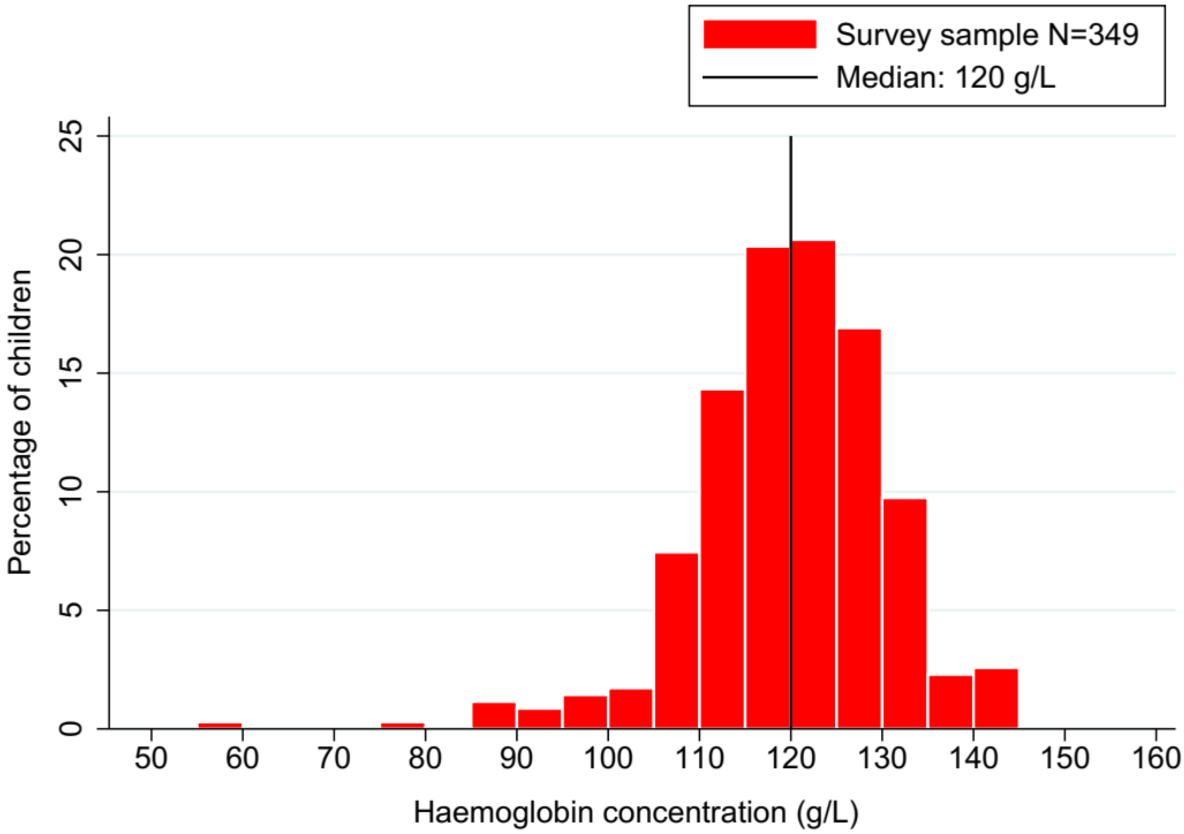

Figure 4. Adjusted haemoglobin (g/L) distribution in children 6–59 months of age, Montenegro 2022

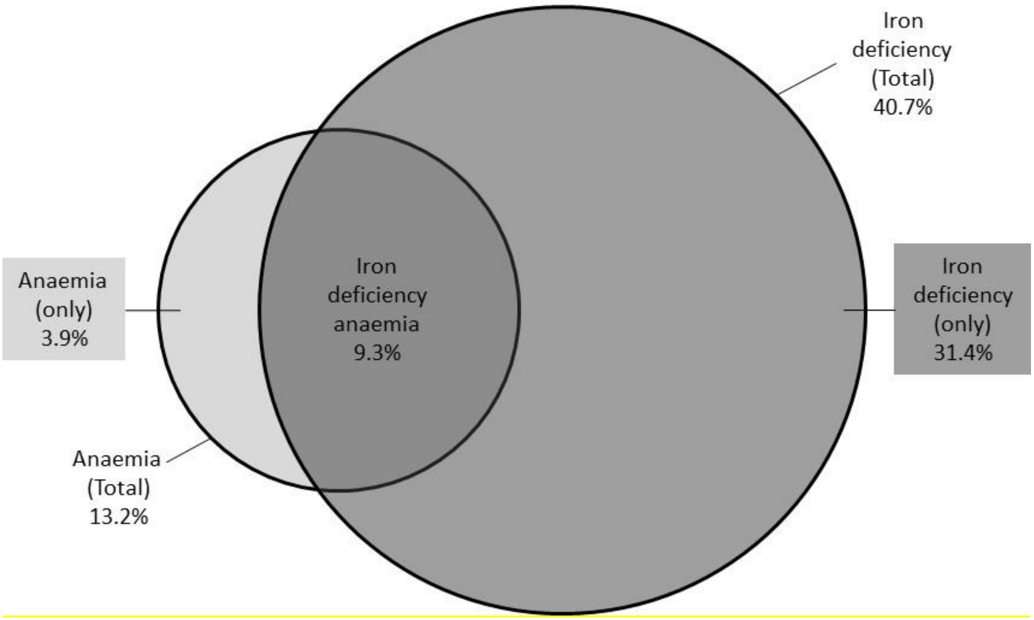

Figure 5. Venn diagram showing overlap between anaemia and iron deficiency in children 6–59 months of age, Montenegro 2022

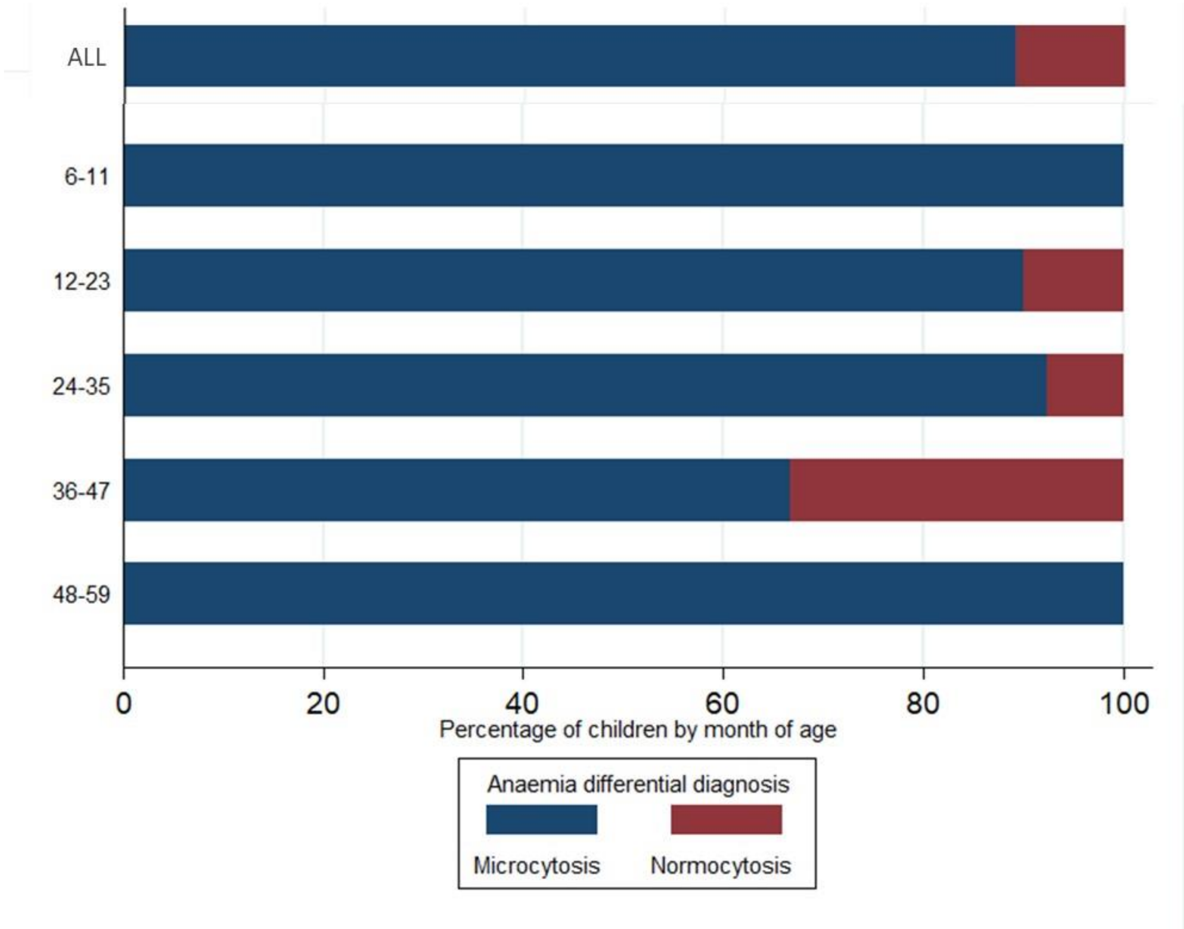

Figure 6. Anaemia type based on mean corpuscular volume (MCV) among *anaemic* children 6–59 months of age, by age group, Montenegro 2022

Table 18. Prevalence of anaemia, iron deficiency, and iron deficiency anaemia in children 6–59 months, by various demographic characteristics, Montenegro 2022.

	Anaemia [b]				Iron deficiency [e]				Iron deficiency anaemia [f]			
Characteristic	**N**	**% [a]**	**[95% CI] [c]**	**p-value [d]**	**N**	**% [a]**	**[95% CI] [c]**	**p-value [d]**	**N**	**% [a]**	**[95% CI] [c]**	**p-value [d]**
Age group (in months)				<0.001				<0.001				<0.001
6–11	26	18.4	[8.0, 36.8]		26	24.5	[12.0, 43.6]		26	4.3	[0.6, 25.8]	
12–23	68	29.8	[21.8, 39.4]		68	68.4	[53.6, 80.3]		68	25.4	[17.5, 35.4]	
24–35	98	13.5	[7.4, 23.4]		97	48.9	[39.3, 58.6]		97	9.6	[5.1, 17.3]	
36–47	66	8.9	[4.1, 18.2]		66	29.6	[19.4, 42.4]		66	4.2	[1.4, 12.0]	
48–59	91	2.3	[0.6, 9.1]		91	24.4	[16.2, 34.8]		91	2.3	[0.6, 9.1]	
Low birth weight				0.428				0.180				0.135
Yes	15	19.7	[6.6, 45.9]		15	25.9	[11.0, 49.6]		15	19.7	[6.6, 45.9]	
No	327	12.9	[9.6, 17.0]		326	41.3	[35.2, 47.7]		326	8.7	[6.1, 12.3]	
Sex				0.237				0.096				0.879
Male	182	11.3	[7.6, 16.3]		181	44.9	[37.0, 53.0]		181	9.0	[5.8, 13.9]	
Female	167	15.3	[10.4, 21.8]		167	36.2	[28.5, 44.6]		167	9.5	[5.7, 15.5]	
Residence				0.507				0.080				0.090
Urban	199	14.3	[10.3, 19.5]		198	46.0	[38.4, 53.8]		198	11.8	[8.0, 17.2]	
Rural	150	11.8	[7.1, 18.9]		150	33.9	[24.0, 45.3]		150	6.0	[2.9, 12.1]	
Region				0.936				0.341				0.850
South	89	12.4	[7.5, 19.7]		88	34.1	[27.2, 41.8]		88	8.0	[3.8, 15.7]	
Centre	174	13.8	[9.1, 20.3]		174	43.7	[33.9, 54.0]		174	9.2	[5.6, 14.8]	
North	86	12.8	[7.1, 21.9]		86	40.7	[30.6, 51.6]		86	10.5	[5.5, 19.0]	
Wealth quintile				0.673				0.442				0.650
Lowest	88	11.1	[6.1, 19.5]		88	33.9	[23.4, 46.1]		88	9.0	[4.3, 17.7]	
Second	71	17.8	[11.3, 27.0]		71	47.8	[37.4, 58.4]		71	12.2	[6.9, 20.8]	
Middle	63	11.6	[5.7, 22.4]		62	39.8	[25.4, 56.2]		62	8.6	[3.9, 17.8]	
Fourth	66	11.0	[5.4, 21.2]		66	38.5	[27.0, 51.5]		66	11.0	[5.4, 21.2]	
Highest	61	14.9	[7.3, 28.0]		61	46.3	[33.7, 59.4]		61	5.0	[1.5, 14.8]	
TOTAL	349	13.2	[9.9, 17.3]		348	40.7	[34.7, 47.0]		348	9.3	[6.6, 13.0]	

Note: The N numbers are the denominators for a specific sub-group. For iron deficiency and iron deficiency anaemia, the numbers are smaller than for anaemia due to unsuccessful blood collection (only sufficient blood could be obtained for the analysis of complete blood count, including haemoglobin concentration). Sub-groups that do not sum to the total have missing data.

[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions. // [b] Anaemia defined as haemoglobin <110 g/L adjusted for altitude.

[c] CI = confidence interval calculated taking into account the complex sampling design. // [d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.

[e] Iron deficiency defined as plasma ferritin <12.0 µg/L. // [f] Iron deficiency anaemia defined as plasma ferritin <12.0 µg/L and haemoglobin <110 g/L, adjusted for altitude.

3.3.9. Vitamin A deficiency

Vitamin A deficiency is extremely rare in preschool children. Only three children are deficient in vitamin A, resulting in a prevalence below 1 per cent. Due to the very low prevalence, no statistically significant associations were observed.

3.3.10. Vitamin D deficiency and insufficiency

The prevalence of vitamin D deficiency and insufficiency are shown in Table 19 by various demographic characteristics. In total, fewer than 4 per cent of children are deficient in vitamin D, with similarly low deficiency prevalences for the various sub-groups. Vitamin D insufficiency is more common and was found in nearly 19 per cent of children. The combined prevalence of vitamin D deficiency and insufficiency is approximately 22 per cent, and no statistically significant associations were observed according to the various demographic risk factors. However, the p-values comparing the prevalence between boys and girls was nearly significant, with a lower prevalence found in boys.

Table 19. Prevalence of vitamin D deficiency and insufficiency in children 6–59 months, by various demographic characteristics, Montenegro 2022

		Deficient [a]		Insufficient [a]		Deficient or insufficient		
Characteristic	**N**	**% [b]**	**[95% CI] [c]**	**% [b]**	**[95% CI] [c]**	**% [b]**	**[95% CI] [c]**	**p-value [d]**
Age group (in months)								0.394
6–11	26	3.4	[0.4, 21.1]	7.6	[1.9, 25.6]	11.0	[3.7, 28.7]	
12–23	61	3.3	[0.9, 12.0]	17.7	[9.6, 30.5]	21.0	[12.3, 33.5]	
24–35	96	6.5	[3.0, 13.5]	21.6	[14.2, 31.5]	28.2	[20.1, 38.0]	
36–47	65	3.1	[0.7, 12.2]	18.2	[10.0, 30.9]	21.3	[12.4, 34.2]	
48–59	88	1.1	[0.1, 7.8]	20.0	[12.9, 29.8]	21.2	[13.8, 31.0]	
Sex								0.056
Male	174	1.7	[0.5, 5.4]	16.3	[11.1, 23.3]	18.0	[12.6, 25.1]	
Female	162	5.6	[3.0, 10.4]	21.4	[15.5, 28.8]	27.0	[20.4, 34.9]	
Residence								0.224
Urban	191	3.6	[1.7, 7.8]	21.3	[15.8, 28.2]	25.0	[18.7, 32.5]	
Rural	145	3.6	[1.6, 7.8]	15.5	[10.0, 23.2]	19.1	[13.4, 26.5]	
Region								0.497
South	85	3.5	[1.1, 11.1]	22.4	[14.6, 32.7]	25.9	[16.4, 38.3]	
Centre	167	3.0	[1.3, 6.8]	20.4	[14.0, 28.7]	23.4	[16.8, 31.5]	
North	84	4.8	[1.8, 11.8]	13.1	[7.1, 22.8]	17.9	[11.1, 27.5]	
Wealth quintile								0.789
Lowest	86	6.9	[3.3, 13.9]	16.8	[9.1, 29.0]	23.8	[14.6, 36.2]	
Second	68	0	[0, 0]	16.0	[8.7, 27.6]	16.0	[8.7, 27.6]	
Middle	60	3.3	[0.9, 11.9]	21.4	[12.3, 34.6]	24.7	[15.4, 37.2]	
Fourth	63	2.9	[0.7, 11.1]	22.2	[12.2, 37.0]	25.2	[14.0, 41.1]	
Highest	59	3.5	[0.9, 13.5]	18.7	[9.8, 32.8]	22.3	[12.5, 36.5]	
TOTAL	336	3.6	[2.1, 6.3]	18.7	[14.6, 23.8]	22.4	[17.9, 27.6]	

Note: The N numbers are the denominators for a specific sub-group.
[a] Deficient: <12.0 ng/mL; Insufficient: 12.0–19.9 ng/mL.
[b] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.
[c] CI = confidence interval calculated taking into account the complex sampling design.
[d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.

3.3.11. Associations between micronutrient deficiencies and various factors

Analyses examining the health and nutritional factors associated with anaemia find that only iron deficiency is significantly associated with anaemia in children (Table 20). The prevalence of anaemia among iron-deficient children is more than three times as large as the prevalence in iron-replete children. No associations between iron deficiency and the explored health or nutrition factors are significant (Table 21). Regarding vitamin D, only inflammation is significantly associated with vitamin D deficiency or insufficiency (Table 22). Children with no inflammation have substantially higher vitamin D deficiency or insufficiency prevalence. No indicators of recent illness, dietary diversity and supplement consumption are associated with vitamin D deficiency or insufficiency.

Table 20. Association between anaemia and various factors in children 6–59 months of age, Montenegro 2022

Characteristic	N	% [a] Anaemia	p-value [b]
Child had diarrhoea			0.454
No	336	12.8	
Yes	13	22.1	
Child had a fever			0.717
No	289	12.9	
Yes	60	14.7	
Child had a lower respiratory infection			0.153
No	347	13.0	
Yes	2	47.5	
Consumed five or more food groups in the previous day			0.842
No	84	12.9	
Yes	258	13.7	
Consumed commercially fortified baby cereal			0.406
No	315	13.1	
Yes	26	18.3	
Consumed infant formula with added iron			0.189
No	330	13.1	
Yes	11	25.8	
Took an iron tablet or syrup in the previous six months			0.843
No	333	13.5	
Yes	9	11.1	
Took a multivitamin supplement in the previous six months			0.505
No	283	14.1	
Yes	58	10.5	
Child had inflammation			0.509
No	222	12.3	
Yes	126	14.9	
Child iron-deficient			<0.001
No	207	6.7	
Yes	141	22.8	
Child's vitamin D status			0.816
Normal	259	11.6	
Insufficient	64	14.3	
Deficient	12	14.7	

Note: The N numbers are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

Table 21. Association between iron deficiency and various factors in children 6–59 months of age, Montenegro 2022

Characteristic	N	% [a] Iron-deficient	p-value [b]
Child had diarrhoea			0.624
No	335	40.4	
Yes	13	47.1	
Child had a fever			0.181
No	288	42.6	
Yes	60	31.4	
Child had a lower respiratory infection			0.090
No	346	40.4	
Yes	2	100	
Consumed five or more food groups in the previous day			0.942
No	84	41.2	
Yes	257	40.8	
Consumed commercially fortified baby cereal			0.564
No	314	41.5	
Yes	26	35.7	
Consumed infant formula with added iron			0.112
No	329	41.5	
Yes	11	18.4	
Took iron tablet or syrup in the previous six months			0.873
No	332	40.8	
Yes	9	43.9	
Took multivitamin supplement in the previous six months			0.557
No	283	41.5	
Yes	57	37.1	
Child had inflammation			0.494
No	222	42.2	
Yes	126	38.1	
Child's vitamin D status			0.178
Normal	259	39	
Insufficient	64	41.2	
Deficient	12	66.6	

Note: The N numbers are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

Table 22. Association between vitamin D deficiency or insufficiency and various factors in children 6–59 months of age, Montenegro 2022

Characteristic	N	% Vitamin D-deficient or -insufficient [a]	p-value [b]
Child had diarrhoea			0.093
No	324	23.2	
Yes	12	0	
Child had a fever			0.233
No	278	23.5	
Yes	58	16.7	
Child had a lower respiratory infection			0.464
No	334	22.5	
Yes	2	0	
Consumed five or more food groups in the previous day			0.537
No	84	20.1	
Yes	246	23.7	
Consumed commercially fortified baby cereal			0.157
No	303	23.8	
Yes	26	11.7	
Took a multivitamin supplement in the previous six months			0.281
No	273	24.1	
Yes	56	17.0	
Child had inflammation			0.006
No	215	27.5	
Yes	120	13.3	

Note: The N numbers are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

3.3.12. Associations between sun exposure and vitamin D deficiency

No significant associations were observed between various indicators of sun exposure and the prevalence of vitamin D deficiency or insufficiency (Table 23). Throughout all sub-groups, vitamin D deficiency remained below 10 per cent. Vitamin D insufficiency was more common, frequently affecting more than 20 per cent of the children in various sub-groups.

Table 23. Association between vitamin D deficiency or insufficiency and sun exposure indicators in children 6–59 months of age, Montenegro 2022

Characteristic	N	%[a] Deficient	%[a] Insufficient	%[a] Deficient or insufficient	p-value[b]
Usually protects head from sun when outside					0.522
Never/rarely	160	5.2	17.3	22.4	
Sometimes	99	2.9	24.4	27.3	
Most of the time	60	0	17.0	17.0	
All the time	11	8.4	9.3	17.7	
Usually covers arms when outside					0.220
Never/rarely	300	3.8	20.1	23.8	
Sometimes	25	3.5	11.7	15.2	
Most of the time	5	0	0	0	
All the time	0	-	-	-	
Usually covers hands when outside					0.528
Never/rarely	320	3.5	19.7	23.2	
Sometimes	9	9.9	0	9.9	
Most of the time	1	0	0	0	
All the time	0	-	-	-	
Approximate daily time spent in the sun					0.288
1–59 minutes	15	7.0	0	7.0	
1–2 hours	77	5.3	21.2	26.5	
2–3 hours	135	5.2	20.6	25.8	
>3 hours	103	0	18.5	18.5	
Usually uses sunscreen					0.490
Never/rarely	187	4.4	20.5	24.8	
Sometimes	100	3.9	18.4	22.3	
Most of the time	33	0	12.2	12.2	
All the time	10	0	21.0	21.0	
Child's skin colour					0.288
Very white/white	172	2.3	17.3	19.6	
Olive	131	4.8	20.1	24.9	
Dark/very dark	27	7.3	26.0	33.3	
Sun exposure index					0.239
20+	235	4.3	20.6	25.0	
10–19.9	44	2.0	21.4	23.4	
0.01–9.9	41	2.8	7.1	10.0	
0	10	0	21.0	21.0	

Note: The N numbers are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

3.4. All women

3.4.1. Demographic characteristics

Table 24 presents the demographic characteristics of the women — both non-pregnant 15–49 years of age and pregnant of any age — participating in the MONS. These results show that the regional distribution of the MONS survey population is roughly similar to the actual Montenegrin population based on the 2011 census data, with most women residing in the central region. Similar to the findings of the children, however, the MONS contained a smaller proportion of women from urban areas than the 2011 census.

The distribution of women by age group is uneven, with 70 per cent of women between 30 and 49 years of age. Approximately 84 per cent of the surveyed women have completed secondary school or have completed more advanced studies. Nearly 60 per cent of the women participating in the MONS report not currently being engaged in paid work, and almost 30 per cent report being employed in a skilled profession.

Table 24 also presents the complete set of categories for marital status and shows that the vast majority of women belong to one of two categories: never married, and legally married. Due to the small proportion of women who were part of other categories, the marital status categories displayed in the tables in Sections 3.4, 3.5 and 3.6 have been condensed into three categories: 1) Never married; 2) Legally married, or living together but not legally married (displayed in tables as “Legally married/living together”); and 3) Legally divorced, separated or widowed (displayed in the tables as “Divorced/separated/widowed”). Importantly, there is a clear correlation between these marital categories and age groups: women reporting as “Never married”, “Legally married/living together” or “Divorced/separated/widowed” have mean ages of 24.9, 37.6 and 39.6 years, respectively.

Lastly, one woman was above 50 years of age. This woman was pregnant and therefore included in the pregnant women analysis (see Section 3.6). The age of this woman was confirmed with the survey coordinators to ensure that no data collection error had occurred. Apart from Table 24, this woman was excluded from the analyses conducted for “all women” to facilitate the calculation of the chi-squared statistics.

Table 24. Description of non-pregnant women 15–49 years of age and pregnant women of any age, Montenegro 2022

Characteristic	N	% [a]	[95% CI] [b]	% in 2011 census
Age group (in years)				
15–19	155	9.4	[8.0, 11.0]	--
20–29	345	20.6	[18.5, 22.9]	--
30–39	610	35.6	[33.0, 38.3]	--
40–49	587	34.4	[32.1, 36.7]	--
50+	1	0.1	[0.0, 0.5]	--
Residence				
Urban	1006	59.9	[50.2, 68.8]	68.1%
Rural	692	40.1	[31.2, 49.8]	31.9%
Region				
South	535	31.5	[25.7, 38.0]	24.1%
Centre	772	45.5	[39.2, 51.8]	48.9%
North	391	23.0	[19.3, 27.2]	27.0%
Wealth quintile				
Lowest	338	22.3	[18.6, 26.6]	--
Second	331	19.9	[17.2, 22.9]	--
Middle	365	21.4	[18.2, 25.0]	--
Fourth	330	18.6	[15.8, 21.8]	--
Highest	334	17.8	[14.4, 21.7]	--
Educational attainment [c]				
Lower attainment	256	16.1	[13.4, 19.3]	--
Higher attainment	1442	83.9	[80.7, 86.6]	--
Working activity				
No paid work	993	58.9	[54.7, 63.0]	--
Unskilled labour	210	11.9	[9.8, 14.4]	--
Skilled labour	477	28.2	[24.3, 32.4]	--
Own business	18	1.0	[0.6, 1.6]	--
Marital status				
Never married	459	27.4	[25.0, 29.9]	--
Legally married	1126	66.1	[63.6, 68.4]	--
Living together with partner but not legally married	46	2.7	[1.9, 3.6]	--
Legally divorced	53	3.1	[2.2, 4.2]	--
Separated	3	0.2	[0.1, 0.5]	--
Widowed	11	0.7	[0.4, 1.2]	--
TOTAL	1698	100		

Note: The N numbers are the numerators for a specific sub-group.

[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.

[b] CI = confidence interval, calculated taking into account the complex sampling design.

[c] Categories based on the distribution of the education data.

3.4.2. Pregnancy and lactation

Table 25 presents the pregnancy and lactation status of all women included in the MONS. Of the women surveyed, approximately 4 per cent were pregnant, and most of these pregnant women reported being in the second or third trimester of pregnancy. About 30 per cent of the surveyed women reported having never been pregnant, and more than 50 per cent of the women reported having been pregnant one to three times. Of the women that reported having delivered one or more children, nearly 20 per cent of women reported having given birth in the previous two years. The majority of women (~78%) reported having two or more deliveries. The differences between the number of pregnancies and deliveries is likely explained by miscarriages.

Nearly 45 per cent of women reported taking iron supplements during their last pregnancy. Of these women, the duration of supplement consumption was high, with approximately 70 per cent taking iron supplements for three or more months, and 30 per cent of women taking iron supplements for seven to nine months. More than half of women with at least one delivery reported having taken folic acid supplements during their last pregnancy. Taking the supplements for three to four months (~40%) and seven or more months (~30%) were the most commonly reported durations.

Approximately 7 per cent of women with at least one delivery reported that they were currently breastfeeding. Among breastfeeding women, similar proportions (~25%) of women reported breastfeeding for either one to three months, four to six months, or more than one year.

Table 25. Pregnancy and lactation status of non-pregnant women 15–49 years of age and pregnant women, Montenegro 2022

Characteristic	N	% [a]	[95% CI] [b]
Currently pregnant			
No	1633	96.1	[95.1, 97.0]
Yes	65	3.9	[3.0, 4.9]
Don't know	0	-	-
Trimester of pregnancy			
1	10	15.4	[8.1, 27.2]
2	29	46.8	[35.7, 58.2]
3	26	37.8	[26.6, 50.6]
Total number of pregnancies			
0	514	30.5	[28.0, 33.0]
1	196	10.9	[9.5, 12.6]
2	451	25.6	[23.4, 28.0]
3	323	19.6	[17.7, 21.6]
4	125	7.8	[6.6, 9.2]
5+	89	5.6	[4.4, 7.1]

Table continued on next page

Characteristic	N	% [a]	[95% CI] [b]
Number of deliveries [c]			
0	31	2.5	[1.7, 3.8]
1	235	19.3	[17.3, 21.5]
2	501	41.1	[38.2, 44.0]
3	310	27.4	[24.7, 30.1]
4	78	7.1	[5.7, 8.8]
5+	29	2.7	[1.7, 4.1]
Gave birth in the previous two years [d]			
No	936	80.7	[78.3, 82.9]
Yes	217	19.3	[17.1, 21.7]
Took iron supplements during the last pregnancy [d]			
No	600	52.6	[48.2, 57.1]
Yes	512	44.1	[39.9, 48.5]
Don’t know	41	3.2	[2.1, 4.9]
Took iron supplements for how long [e]			
Less than one month	13	2.5	[1.3, 4.8]
1–2 months	123	24.0	[19.9, 28.7]
3–4 months	125	24.9	[21.2, 29.0]
5–6 months	67	13.1	[10.6, 16.1]
7 or more months	164	31.6	[26.7, 37.0]
Don’t know	20	3.9	[2.5, 6.1]
Took folic acid supplements during the last pregnancy [d]			
No	461	40.6	[36.7, 44.5]
Yes	634	54.8	[51.0, 58.6]
Don’t know	58	4.6	[3.2, 6.7]
Took folic acid supplements for how long [f]			
Less than one month	6	0.9	[0.4, 2.0]
1–2 months	112	18.1	[14.3, 22.6]
3–4 months	255	40.3	[34.7, 46.2]
5–6 months	56	9.2	[7.0, 11.9]
7 or more months	189	29.1	[23.4, 35.5]
Don’t know	16	2.4	[1.4, 3.9]
Currently breastfeeding [d]			
No	1079	93.3	[91.8, 94.5]
Yes	74	6.7	[5.5, 8.2]
Duration of current breastfeeding [g]			
1–3 months	21	28.8	[19.0, 41.2]
4–6 months	18	25.5	[16.4, 37.2]
7–9 months	5	6.3	[2.6, 14.5]
10–12 months	6	7.2	[2.9, 16.5]
>1 year	20	26.9	[17.1, 39.7]
>2 years	4	5.3	[1.9, 14.0]

Note: The N numbers are the numerators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] CI = confidence interval calculated taking into account the complex sampling design.

[c] Only includes women with a total number of pregnancies greater than 0.

[d] Only includes women with a total number of deliveries greater than 0.

[e] Only includes women who took iron supplements.

[f] Only includes women who took folic acid supplements.

[g] Only includes currently breastfeeding women.

3.4.3. Dietary diversity

As shown in Table 26, more than 75 per cent of women have a minimum diverse diet and women consumed an average of 5.9 food groups the day before the survey. Minimum dietary diversity is significantly associated with age group, with adolescent girls 15–19 years of age displaying the lowest levels of dietary diversity. Dietary diversity is also significantly lower in women residing in urban areas and the central region. The general occupation category is also significantly associated with dietary diversity, with the lowest prevalence of minimum dietary diversity in women involved in unskilled labour. Marital status is also significantly associated with dietary diversity, with the highest prevalence (~79%) found among women who are legally married or living with a partner but not legally married. Lastly, minimum dietary diversity is significantly higher among breastfeeding women.

Table 26. Dietary diversity in non-pregnant women 15–49 years of age and pregnant women, by various demographic characteristics, Montenegro 2022

		Consumed 5+ food groups			Mean dietary
Characteristic	**N**	**% [a]**	**[95% CI] [b]**	**p-value [c]**	**score [a]**
Age group (in years) [d]				0.048	
15–19	155	67.3	[57.8, 75.6]		5.4
20–29	345	74.3	[68.2, 79.6]		5.8
30–39	610	77.7	[73.6, 81.3]		6.1
40–49	587	77.7	[73.0, 81.8]		6.0
Residence				0.032	
Urban	1006	73.2	[68.2, 77.6]		5.8
Rural	692	80.3	[75.6, 84.3]		6.2
Region				0.002	
South	535	82.2	[76.0, 87.1]		6.3
Centre	772	70.3	[64.3, 75.7]		5.7
North	391	80.8	[75.6, 85.2]		6.0
Wealth quintile				0.117	
Lowest	338	73.2	[66.5, 79.1]		5.6
Second	331	72.4	[66.4, 77.7]		5.8
Middle	365	75.1	[68.3, 80.8]		5.8
Fourth	330	79.4	[73.9, 84.0]		6.1
Highest	334	81.2	[74.8, 86.2]		6.4
Educational attainment [e]				0.067	
Lower attainment	256	71.0	[63.2, 77.7]		5.6
Higher attainment	1442	77.0	[73.6, 80.1]		6.0
Working activity				0.040	
No paid work	993	77.3	[72.9, 81.1]		6.1
Unskilled labour	210	68.4	[61.1, 74.9]		5.5
Skilled labour/own business	495	76.6	[72.2, 80.5]		5.8
Marital status				0.002	
Never married	459	70.8	[65.0, 76.0]		5.7
Legally married/living together	1172	78.5	[74.8, 81.7]		6.0
Divorced/separated/widowed	67	70.0	[60.1, 78.3]		5.5

Table continued on next page

Characteristic	N	Consumed 5+ food groups % [a]	[95% CI] [b]	p-value [c]	Mean dietary score [a]
Currently pregnant				0.066	
No	1633	75.6	[72.0, 78.9]		5.9
Yes	65	87.0	[74.6, 93.8]		6.7
Currently breastfeeding				0.031	
No	1624	75.6	[71.9, 78.9]		5.9
Yes	74	85.9	[76.7, 91.8]		6.2
TOTAL	1698	76.0	[72.5, 79.2]		5.9

Note: The N numbers are the denominators for a specific sub-group.

[a] All percentages and means, except region-specific estimates, are weighted for unequal probability of selection among regions.

[b] CI = confidence interval, calculated taking into account the complex sampling design.

[c] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.

[d] One pregnant woman aged >49 years was removed from the analysis. [e] Categories based on the distribution of the education data.

3.4.4. History of cardiometabolic diseases

As shown in Table 27, two thirds of the women surveyed have ever had their cholesterol/ triglycerides measured. No significant difference between pregnant and non-pregnant women was observed, as cholesterol/triglycerides were measured in 66 per cent of non-pregnant women and 68 per cent of pregnant women. Among all women who reported having their cholesterol/triglycerides measured, approximately 17 per cent reported having raised cholesterol or triglycerides. Again, no significant differences were observed between non-pregnant and pregnant women. Of all the women surveyed, few reported ever taking medication for raised cholesterol or triglycerides.

Approximately two thirds of all the women also reported ever having their blood sugar measured, with a higher percentage of pregnant women (76%) than non-pregnant women (67%) reporting ever having their blood sugar tested. Nationally, only 6 per cent reported having elevated blood glucose levels. Very few women reported currently taking insulin or other medication to control their blood glucose level.

Approximately 10 per cent of all women reported ever having hypertension, with nearly two thirds of these women reporting having ever taken prescribed medicine for high blood pressure. Few women reported currently taking blood pressure medication.

Table 27. History of cardiometabolic diseases in non-pregnant women 15–49 years of age and pregnant women, Montenegro 2022

Characteristic	N	% [a]	[95% CI] [b]
Ever had cholesterol or triglycerides measured			
No	552	33.6	[27.4, 40.5]
Yes	1146	66.4	[59.5, 72.6]
Ever had raised cholesterol or triglycerides [c]			
No	960	82.8	[79.9, 85.5]
Yes	186	17.2	[14.5, 20.1]
Took any prescribed oral medication for raised total cholesterol or triglycerides, in the previous two weeks [d]			
No	159	86.3	[80.5, 90.6]
Yes	27	13.7	[9.4, 19.5]
Ever seen a traditional/alternative healer for raised cholesterol or triglycerides [d]			
No	184	99.0	[96.1, 99.8]
Yes	2	1.0	[0.2, 3.9]
Currently taking any herbal or traditional remedy for raised cholesterol or triglycerides [d]			
No	172	92.5	[87.2, 95.8]
Yes	14	7.5	[4.2, 12.8]
Ever had blood sugar or other diabetes test measured			
No	536	32.9	[26.5, 40.1]
Yes	1162	67.1	[59.9, 73.5]
Ever had raised blood sugar or diabetes [c]			
No	1091	93.9	[92.3, 95.2]
Yes	71	6.1	[4.8, 7.7]
Currently taking prescribed insulin injection for diabetes [d]			
No	65	91.0	[81.2, 96.0]
Yes	6	9.0	[4.0, 18.8]
Currently taking any prescribed medicines, tablets or pills (other than insulin injections) for diabetes [d]			
No	50	71.5	[58.9, 81.5]
Yes	21	28.5	[18.5, 41.1]
Ever seen a traditional/alternative healer for raised blood sugar or diabetes [d]			
No	70	98.9	[92.2, 99.9]
Yes	1	1.1	[0.1, 7.8]
Currently taking any herbal or traditional/alternative remedy for diabetes [d]			
No	70	98.5	[89.0, 99.8]
Yes	1	1.5	[0.2, 11.0]
Ever had hypertension			
No	1535	90.2	[88.2, 91.9]
Yes	163	9.8	[8.1, 11.8]
Took prescribed medicine for high blood pressure [d]			
No	58	36.3	[28.8, 44.6]
Yes	105	63.7	[55.4, 71.2]
Currently taking prescribed medicine for high blood pressure [d]			
No	93	57.7	[49.6, 65.4]
Yes	70	42.3	[34.6, 50.4]

Note: The N numbers are the numerators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] CI = confidence interval calculated taking into account the complex sampling design.

[c] Only includes women with the respective cardiometabolic disease ever measured.

[d] Only includes women ever having the respective cardiometabolic disease.

3.4.5. Smoking

As shown in Table 28, approximately 27 per cent of women report smoking at least one cigarette per day. Cigarette smoking is significantly associated with age group. The prevalence of smokers increases consistently by age group, and about 36 per cent of women 40–49 years of age are smokers. Smoking is also associated with working activity and marital status, with the highest prevalences found among women with unskilled jobs and women that are divorced, separated or widowed. The association with marital status may, however, be due to the correlation between age group and marital status.

No significant difference was observed by pregnancy or lactation status. Nonetheless, it is notable that approximately 21 per cent of pregnant women and 18 per cent of lactating women are smokers.

While a threshold of one cigarette per day is used to create the dichotomous variable examined in Table 28, Figure 7 illustrates that fewer than 5 per cent of smokers have more than 10 cigarettes per day. Furthermore, approximately 15 per cent of women reported smoking 20–39 cigarettes per day.

Table 28. Prevalence of tobacco smoking in non-pregnant women 15–49 years of age and pregnant women, by various demographic characteristics, Montenegro 2022

	Smokes one or more cigarettes daily			
Characteristic	**N**	**% [a]**	**[95% CI] [b]**	**p-value [c]**
Age group (in years) [d]				<0.001
15–19	155	6.7	[3.4, 12.7]	
20–29	345	19.5	[15.7, 24.0]	
30–39	609	27.6	[23.7, 31.8]	
40–49	585	36.1	[32.1, 40.4]	
Residence				0.281
Urban	1004	28.1	[24.9, 31.6]	
Rural	691	25.0	[20.7, 29.8]	
Region				0.930
South	534	27.7	[23.3, 32.6]	
Centre	770	26.6	[22.7, 30.9]	
North	391	26.6	[21.5, 32.4]	
Wealth quintile				0.945
Lowest	337	26.2	[20.7, 32.4]	
Second	330	28.5	[23.8, 33.6]	
Middle	365	26.3	[21.8, 31.4]	
Fourth	329	26.1	[21.2, 31.6]	
Highest	334	27.5	[22.4, 33.2]	
Educational attainment [e]				0.809
Lower attainment	256	26.2	[20.7, 32.6]	
Higher attainment	1439	27.0	[24.2, 30.0]	
Working activity				<0.001
No paid work	992	23.8	[20.6, 27.2]	
Unskilled labour	210	39.1	[32.0, 46.6]	
Skilled labour/own business	493	28.2	[24.5, 32.3]	
Marital status				<0.001
Never married	459	16.9	[13.5, 21.0]	
Legally married/living together	1170	30.3	[27.3, 33.5]	
Divorced/separated/widowed	66	36.8	[26.3, 48.7]	
Currently pregnant				0.277
No	1630	27.1	[24.5, 29.9]	
Yes	65	20.8	[12.1, 33.5]	
Currently breastfeeding				0.173
No	1621	27.3	[24.6, 30.2]	
Yes	74	18.1	[9.3, 32.3]	
TOTAL	1695	26.9	[24.2, 29.7]	

Note: The N numbers are the denominators for a specific sub-group.

[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.

[b] CI = confidence interval, calculated taking into account the complex sampling design.

[c] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.

[d] One pregnant woman aged >49 years was removed from analysis.

[e] Categories based on the distribution of the education data.

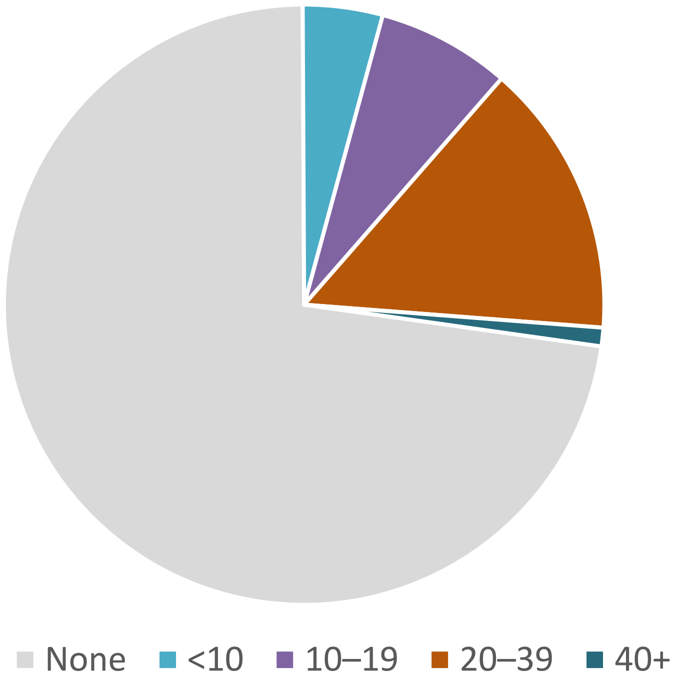

Figure 7. Number of cigarettes smoked per day in non-pregnant women 15–49 years of age and pregnant women, Montenegro 2022

3.5. Non-pregnant women of reproductive age

3.5.1. Consumption of mineral and vitamin supplements

As shown in Table 29, the consumption of single-nutrient micronutrient supplements by non-pregnant women is relatively rare. In the previous six months, fewer than 5 per cent of non-pregnant women reported consuming folic acid, vitamin B12 or vitamin A supplements, and approximately 10 per cent of women reported taking iron or vitamin D supplements. Multivitamins were the most commonly consumed supplements and were consumed by 17 per cent of non-pregnant women in the previous six months. About one half of women who reported consuming any of the supplements in the previous six months were still taking the supplement at the time of the survey. More than 80 per cent of the women taking iron or folic acid supplements in the previous six months reported that their doctor had prescribed these supplements. Other micronutrients were prescribed less frequently to about a half or fewer of those taking the supplements.

The consumption of medication for the treatment or prevention of intestinal parasites was rare and reported by fewer than 1 per cent of women.

Table 29. Consumption of mineral and vitamin supplements and drug for intestinal worms in non-pregnant women 15–49 years of age, Montenegro 2022

Characteristic	N	% [a]	[95% CI] [b]
Took iron tablet or syrup in the previous six months			
No	1471	90.2	[88.4, 91.7]
Yes	158	9.6	[8.1, 11.3]
Don’t know	4	0.2	[0.1, 0.7]
Is still taking iron [c]			
No	85	54.4	[45.7, 62.8]
Yes	73	45.6	[37.2, 54.3]
Iron prescribed by a doctor [c]			
No	26	16.8	[11.4, 24.1]
Yes	132	83.2	[75.9, 88.6]
Took folic acid supplements in the previous six months			
No	1567	96.0	[95.0, 96.8]
Yes	62	3.8	[3.0, 4.8]
Don’t know	4	0.2	[0.1, 0.6]
Is still taking folic acid [c]			
No	34	57.3	[44.7, 69.0]
Yes	28	42.7	[31.0, 55.3]
Folic acid prescribed by a doctor [c]			
No	9	14.2	[7.6, 25.1]
Yes	53	85.8	[74.9, 92.4]
Took vitamin D tablets, syrup or spray in the previous six months			
No	1458	89.3	[87.4, 90.9]
Yes	172	10.6	[9.0, 12.5]
Don’t know	3	0.2	[0.1, 0.5]
Is still taking vitamin D [c]			
No	74	44.3	[36.4, 52.4]
Yes	98	55.7	[47.6, 63.6]
Vitamin D prescribed by a doctor [c]			
No	73	43.2	[35.5, 51.2]
Yes	99	56.8	[48.8, 64.5]
Took vitamin A tablets or other preparations in the previous six months			
No	1612	98.7	[98.0, 99.2]
Yes	18	1.1	[0.7, 1.8]
Don’t know	3	0.2	[0.1, 0.6]
Is still taking vitamin A [c]			
No	10	54.9	[30.0, 77.5]
Yes	8	45.1	[22.5, 70.0]
Vitamin A prescribed by a doctor [c]			
No	10	54.9	[33.0, 75.0]
Yes	8	45.1	[25.0, 67.0]
Took multivitamin tablets or other preparations in the previous six months			
No	1355	82.7	[79.6, 85.5]

Characteristic	N	% [a]	[95% CI] [b]
Yes	278	17.3	[14.5, 20.4]
Is still taking multivitamins [c]			
No	134	49.4	[41.6, 57.2]
Yes	144	50.6	[42.8, 58.4]
Multivitamins prescribed by a doctor [c]			
No	175	62.1	[55.2, 68.5]
Yes	103	37.9	[31.5, 44.8]
Took vitamin B12 supplements or received vitamin B12 injections in the previous six months [a]			
No	1540	94.3	[92.5, 95.7]
Yes	89	5.5	[4.2, 7.3]
Is still taking vitamin B12 supplements or receiving vitamin B12 injections [c]			
No	39	45.2	[35.4, 55.3]
Yes	50	54.8	[44.7, 64.6]
Vitamin B12 prescribed by a doctor [c]			
No	48	54.2	[42.4, 65.5]
Yes	41	45.8	[34.5, 57.6]
Took drug for intestinal worms in the previous six months [a]			
No	1626	99.5	[99.1, 99.8]
Yes	6	0.4	[0.2, 0.9]
Drug for intestinal worms prescribed by a doctor [c]			
No	3	53.1	[17.0, 86.2]
Yes	3	46.9	[13.8, 83.0]

Note: The N numbers are the numerators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions. The percentages do not add up to 100% when the small proportion of the respondents that reported “don’t know” or “not applicable” is not shown.

[b] CI = confidence interval calculated taking into account the complex sampling design.

[c] Only includes women responding “Yes” to whether taking the respective supplement/tablet/syrup/preparation/injection/drug.

3.5.2. Sun exposure

Practices related to sun exposure are described in

Table 30. The results show that about 20 per cent of Montenegrin women reported covering their head at times when outside, but only about 6 per cent cover their head “most of the time” or “all the time”. In contrast, covering of arms and hands when outside is infrequently practised. About 40 per cent of women reported using sunscreen, with more than 10 per cent reporting using it “most of the time” or “all the time”. Nearly 60 per cent of women have one hour or more of direct sun exposure per day. In combination with the minimal covering practices, the sun exposure index shows relatively high index scores (i.e. ≥10) for nearly 75 per cent of women.

Table 30. Sun exposure patterns in non-pregnant women 15–49 years of age, Montenegro 2022

Characteristic	N	% [a]	[95% CI] [b]
Usually protects head from sun when outside			
Never/rarely	1264	78.3	[73.6, 82.4]
Sometimes	270	16.0	[12.7, 19.9]
Most of the time	58	3.4	[2.5, 4.5]
All the time	41	2.4	[1.5, 3.7]
How head is protected from sun when outside [c]			
Scarf/headcloth	53	14.5	[8.8, 23.0]
Hat	315	85.2	[76.7, 90.9]
Umbrella	1	0.3	[0.0, 2.1]
Blanket	0	-	-
Usually covers arms when outside			
Never/rarely	1573	96.1	[94.5, 97.3]
Sometimes	39	2.5	[1.6, 3.9]
Most of the time	6	0.3	[0.2, 0.7]
All the time	15	1.0	[0.5, 2.0]
Usually covers hands when outside			
Never/rarely	1613	98.8	[97.9, 99.4]
Sometimes	11	0.7	[0.3, 1.5]
Most of the time	3	0.1	[0.0, 0.6]
All the time	6	0.3	[0.2, 0.8]
Direct sun exposure during [d]			
Walking to bus/taxi	1229	75.3	[67.7, 81.5]
Walking to market and/or work	1430	87.4	[83.1, 90.7]
Working outside	846	53.1	[47.0, 59.0]
Watching children outside	594	36.5	[33.2, 39.8]
Doing household duties outside	792	50.6	[44.3, 56.9]
Sunbathing	40	2.3	[1.3, 3.9]
Strolling	90	5.1	[3.3, 8.0]
Sport	3	0.2	[0.1, 0.5]

Characteristic	N	% [a]	[95% CI] [b]
Table continued on next page			
Approximate daily time spent in the sun			
None	32	1.9	[1.4, 2.8]
1–29 minutes	205	13.2	[10.2, 16.9]
30–59 minutes	309	19.3	[16.5, 22.6]
1–2 hours	604	36.3	[32.9, 40.0]
2–3 hours	373	22.6	[19.5, 25.9]
>3 hours	104	6.6	[5.1, 8.6]
Usually uses sunscreen			
Never/rarely	961	60.5	[54.9, 65.9]
Sometimes	481	28.8	[24.3, 33.9]
Most of the time	133	7.4	[5.7, 9.6]
All the time	58	3.2	[2.2, 4.6]
Respondent skin colour			
Very white	68	4.3	[3.1, 6.0]
White	644	40.2	[34.9, 45.8]
Olive	725	43.5	[37.2, 50.0]
Dark	192	11.7	[8.6, 15.8]
Very dark	2	0.1	[0.0, 0.5]
Unable to observe	2	0.1	[0.0, 0.6]
Sun exposure index			
20+	881	54.2	[49.1, 59.1]
10–19.9	319	19.9	[17.3, 22.8]
0.01–9.9	344	21.1	[17.9, 24.8]
0	83	4.8	[3.6, 6.4]

Note: The N numbers are the numerators for a specific sub-group. Sub-groups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection among regions.
[b] CI = confidence interval calculated taking into account the complex sampling design.
[c] Only includes women protecting their head sometimes, most of the time, or all the time.
[d] Multiple responses possible.

3.5.3. Diabetes mellitus

Diabetes, pre-diabetes and elevated HbA1c (i.e. both pre-diabetes and diabetes combined) are found in a small proportion of non-pregnant women in Montenegro (Table 31). Overall, diabetes is found in fewer than 1 per cent of women and pre-diabetes is found in 3.5 per cent of women. Elevated HbA1 exceeds 5 per cent among women 40–49 years of age, women with lower educational attainment, and women residing in the northern region and in the households in the lowest wealth quintile.

Statistical comparisons made for elevated HbA1c showed significant differences according to age group, education level, marital status and smoking status. The proportion of elevated HbA1c increases with age group, with the highest proportion (>7%) found in women 40–49 years of age. The elevated HbA1c proportion is also significantly higher among women with lower educational attainment, compared to women with more advanced education. Regarding marital status, the highest proportions were found in women that are “legally married or living together with a partner but not legally married". As marital status is likely a proxy of age (see Section 3.4.1), the association between elevated HbA1c and marital status is likely confounded by age. The proportion of elevated HbA1c among smokers (~6%) is nearly two times as high as in non-smokers.

Table 31. Prevalence of diabetes and pre-diabetes in non-pregnant women 15–49 years of age, by various demographic characteristics, Montenegro 2022

		Diabetes [a]		Pre-diabetes [a]		Elevated HbA1c [a]		
Characteristic	**N**	**% [b]**	**[95% CI] [c]**	**% [b]**	**[95% CI] [c]**	**% [b]**	**[95% CI] [c]**	**p-value [d]**
Age group (in years)								<0.001
15–19	153	0	-	1.2	[0.3, 4.6]	1.2	[0.3, 4.6]	
20–29	321	0	-	1.0	[0.3, 3.1]	1.0	[0.3, 3.1]	
30–39	567	0.6	[0.2, 1.7]	2.6	[1.5, 4.5]	3.2	[2.0, 5.2]	
40–49	584	0.8	[0.4, 1.8]	6.3	[4.5, 8.8]	7.2	[5.2, 9.7]	
Residence								0.333
Urban	968	0.6	[0.3, 1.3]	2.9	[2.0, 4.3]	3.6	[2.6, 5.0]	
Rural	657	0.3	[0.1, 1.0]	4.3	[2.8, 6.5]	4.6	[3.1, 6.8]	
Region								0.154
South	517	1.0	[0.4, 2.3]	2.9	[1.6, 5.1]	3.9	[2.4, 6.1]	
Centre	735	0.5	[0.2, 1.3]	2.6	[1.7, 3.9]	3.1	[2.2, 4.4]	
North	373	0	-	5.6	[3.5, 9.1]	5.6	[3.5, 9.1]	
Wealth quintile								0.120
Lowest	324	0.8	[0.3, 2.5]	5.3	[3.1, 8.7]	6.1	[3.8, 9.5]	
Second	320	0	-	4.1	[2.3, 7.1]	4.1	[2.3, 7.1]	
Middle	345	0.5	[0.1, 2.1]	3.4	[2.0, 5.8]	4.0	[2.4, 6.6]	
Fourth	315	0.6	[0.1, 2.5]	2.7	[1.3, 5.5]	3.3	[1.8, 6.2]	
Highest	321	0.5	[0.1, 2.1]	1.4	[0.6, 3.4]	1.9	[0.9, 4.1]	
Educational attainment [e]								0.043
Lower attainment	250	0.8	[0.2, 3.1]	5.3	[3.1, 8.8]	6.1	[3.8, 9.7]	
Higher attainment	1375	0.4	[0.2, 0.9]	3.1	[2.3, 4.2]	3.6	[2.7, 4.7]	
Working activity								0.895
No paid work	937	0.5	[0.2, 1.1]	3.7	[2.6, 5.2]	4.2	[3.1, 5.7]	
Unskilled labour	205	0	-	3.9	[1.9, 7.8]	3.9	[1.9, 7.8]	
Skilled labour/own business	483	0.8	[0.3, 2.0]	2.9	[1.6, 5.1]	3.7	[2.2, 6.0]	
Marital status								0.001
Never married	457	0.2	[0.0, 1.2]	1.2	[0.5, 2.8]	1.4	[0.6, 3.0]	
Legally married/living together	1101	0.6	[0.3, 1.2]	4.7	[3.4, 6.3]	5.3	[4.0, 6.9]	
Divorced/separated/widowed	67	1.1	[0.2, 7.9]	0	-	1.1	[0.2, 7.9]	
Tobacco smoking								0.004
No	1179	0.2	[0.1, 0.7]	2.9	[2.1, 4.1]	3.2	[2.3, 4.4]	
Yes	443	1.3	[0.6, 2.8]	5.0	[3.2, 7.5]	6.2	[4.3, 8.8]	
Currently breastfeeding								0.495
No	1551	0.5	[0.3, 1.0]	3.5	[2.7, 4.7]	4.1	[3.2, 5.2]	
Yes	74	0	-	2.5	[0.6, 10.0]	2.5	[0.6, 10.0]	
TOTAL	1625	0.5	[0.3, 0.9]	3.5	[2.6, 4.6]	4.0	[3.1, 5.1]	

Note: The N numbers are the denominators for a specific sub-group. Sub-groups that do not sum to the total have missing data.

[a] Diabetes defined as glycated haemoglobin (HbA1c) ≥6.5%; pre-diabetes defined as HbA1c ≥5.7% to <6.5%; elevated HbA1c defined as ≥5.7%.

[b] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.

Characteristic	N	Diabetes [a]		Pre-diabetes [a]		Elevated HbA1c [a]		
		% [b]	[95% CI] [c]	% [b]	[95% CI] [c]	% [b]	[95% CI] [c]	p-value [d]

[c] CI = confidence interval calculated taking into account the complex sampling design. [d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others. [e] Categories based on the distribution of the education data.

3.5.4. HDL and triglycerides

Table 32 presents the prevalence of elevated triglycerides, low HDL cholesterol and an elevated triglyceride/HDL ratio. Nearly 14 per cent of non-pregnant women have elevated triglycerides, and the prevalence of elevated triglycerides is significantly associated with age group, region, wealth quintile, education level and marital status. Regarding age, the prevalence increases consistently by age group and affects more than 20 per cent of women 40–49 years of age. Regarding wealth quintile, the prevalence of elevated triglycerides is highest among women residing in households in the lowest wealth quintile, and the prevalence decreases as wealth increases. The prevalence of elevated triglycerides is also highest in the northern region, and among women with lower educational attainment. Women that have never been married have a significantly lower prevalence, but in this case, marital status is likely a proxy of age (see Section 3.4.1). The prevalence of elevated triglycerides is also significantly higher in smokers compared to non-smokers.

Low HDL cholesterol affects about 30 per cent of non-pregnant women and is significantly associated with area of residence (urban/rural), region, wealth quintile, education level, working activity, marital status and smoking status. Specifically, a significantly higher prevalence is found among women residing in rural areas, the northern region and in households from the two lowest wealth quintiles. Women with lower educational attainment also have a higher prevalence, as do women who are not currently engaged in paid work. Regarding marital status, the prevalence of low HDL cholesterol is lowest (~23%) amongst women who have never been married, and is highest among women that are either divorced, separated or widowed. As mentioned above, the association with marital status is likely confounded by age. Low HDL is also more common among smokers.

An elevated triglyceride/HDL ratio was found in approximately 40 per cent of non-pregnant women. The factors significantly associated with an elevated triglyceride/HDL ratio are similar to the factors associated with elevated triglycerides: age group, region, education level, marital status, smoking status and current breastfeeding status. The prevalence of an elevated triglyceride/HDL ratio increases consistently by age group and affects more than half of non-pregnant women 40–49 years of age. Nearly 50 per cent of women in the northern region have an elevated triglyceride/HDL ratio compared to fewer than 40 per cent in the other regions. The prevalence is significantly higher among women with lower educational attainment, compared to their more educated counterparts. Women who have never been married have a significantly lower prevalence of an elevated triglyceride/HDL ratio, but, similar to elevated triglycerides, marital status is likely a proxy of age (see Section 3.4.1) in this instance. Approximately 50 per cent of smokers have an elevated triglyceride/HDL ratio compared to 37% of non-smokers. While non-breastfeeding women have a similar prevalence to the national average (i.e. ~40%), the prevalence of an elevated triglyceride/HDL ratio in women currently breastfeeding is significantly lower.

Table 32. Prevalence with elevated triglycerides, low HDL and elevated triglyceride/HDL ratio in non-pregnant women 15–49 years of age, by various demographic characteristics, Montenegro 2022

	Elevated triglycerides [a]				Low HDL [a]				Elevated triglycerides/HDL ratio [a]			
Characteristic	**N**	**% [b]**	**[95% CI] [c]**	**p-value [d]**	**N**	**% [b]**	**[95% CI] [c]**	**p-value [d]**	**N**	**% [b]**	**[95% CI] [c]**	**p-value [d]**
Age group (in years)				<0.001				0.330				<0.001
15–19	153	3.3	[1.3, 7.8]		151	24.9	[17.5, 34.1]		151	23.9	[16.7, 32.8]	
20–29	320	6.1	[4.0, 9.2]		319	28.9	[23.9, 34.5]		318	25.8	[21.4, 30.8]	
30–39	566	12.9	[10.5, 15.8]		565	30.4	[26.4, 34.7]		563	41.1	[37.0, 45.3]	
40-49	580	22.1	[18.9, 25.6]		580	32.7	[28.5, 37.1]		576	52.7	[48.2, 57.3]	
Residence				0.099				0.034				0.099
Urban	969	12.6	[10.5, 15.0]		959	27.7	[24.6, 31.1]		959	38.4	[34.8, 42.1]	
Rural	650	15.8	[12.9, 19.2]		656	34.4	[29.3, 39.9]		649	43.8	[38.6, 49.1]	
Region				<0.001				0.001				0.002
South	517	13.2	[10.6, 16.2]		517	27.3	[23.2, 31.8]		517	38.9	[33.9, 44.1]	
Centre	736	10.3	[8.1, 13.1]		725	27.2	[23.4, 31.3]		725	36.4	[32.3, 40.7]	
North	366	21.0	[17.5, 25.1]		373	38.9	[33.1, 44.9]		366	49.5	[43.7, 55.2]	
Wealth quintile				0.002				0.001				0.078
Lowest	319	19.1	[15.2, 23.8]		321	38.6	[31.8, 45.9]		316	46.9	[41.1, 52.7]	
Second	319	17.1	[13.2, 22.0]		316	35.1	[30.1, 40.4]		315	42.4	[37.6, 47.3]	
Middle	345	11.2	[7.5, 16.3]		346	25.3	[20.6, 30.7]		345	38.6	[31.9, 45.8]	
Fourth	315	12.3	[9.2, 16.4]		313	26.8	[21.9, 32.4]		313	36.8	[31.5, 42.5]	
Highest	321	8.5	[5.9, 12.0]		319	24.5	[19.0, 30.9]		319	36.6	[30.3, 43.4]	
Educational attainment [e]				0.013				<0.001				<0.001
Lower attainment	249	19.1	[14.5, 24.7]		248	44.3	[36.0, 53.0]		247	50.9	[44.5, 57.2]	
Higher attainment	1370	12.8	[11.1, 14.8]		1367	27.6	[25.0, 30.4]		1361	38.5	[35.4, 41.6]	
Working activity				0.336				0.015				0.123
No paid work	931	14.9	[12.6, 17.4]		928	32.9	[29.5, 36.4]		922	42.2	[38.3, 46.1]	
Unskilled labour	206	11.3	[7.5, 16.6]		206	30.9	[24.5, 38.0]		206	42.6	[36.6, 48.8]	
Skilled labour/own business	482	12.9	[10.2, 16.3]		481	25.3	[21.2, 29.9]		480	36.4	[31.5, 41.7]	

Table continued on next page

	Elevated triglycerides [a]				Low HDL [a]				Elevated triglycerides/HDL ratio [a]			
Characteristic	**N**	**% [b]**	**[95% CI] [c]**	**p-value [d]**	**N**	**% [b]**	**[95% CI] [c]**	**p-value [d]**	**N**	**% [b]**	**[95% CI] [c]**	**p-value [d]**
Marital status				<0.001				<0.001				<0.001
Never married	455	6.3	[4.4, 9.0]		455	22.5	[18.1, 27.5]		453	25.1	[20.4, 30.4]	
Legally married/living together	1098	16.8	[14.8, 19.1]		1093	33.0	[30.0, 36.1]		1089	46.4	[43.2, 49.7]	
Divorced/separated/widowed	66	17.8	[9.9, 29.8]		67	42.5	[31.1, 54.6]		66	51.0	[38.2, 63.6]	
Tobacco smoking				<0.001				<0.001				<0.001
No	1177	11.4	[9.7, 13.2]		1172	26.3	[23.2, 29.7]		1169	36.9	[33.7, 40.2]	
Yes	439	20.5	[16.8, 24.8]		440	41.3	[36.7, 46.1]		436	50.4	[45.2, 55.6]	
Currently breastfeeding				0.686				0.297				0.037
No	1545	13.9	[12.2, 15.9]		1543	30.7	[27.8, 33.7]		1536	41.1	[38.3, 44.0]	
Yes	74	12.3	[6.5, 21.9]		72	24.5	[15.5, 36.5]		72	28.3	[18.4, 40.9]	
TOTAL	1619	13.9	[12.2, 15.7]		1615	30.4	[27.6, 33.3]		1608	40.5	[37.6, 43.4]	

Note: The N numbers are the denominators for a specific sub-group. Sub-groups that do not sum to the total have missing data.

[a] Elevated triglycerides defined as ≥150 mg/dl in fasting women and ≥200 mg/dl in non-fasting women; low HDL cholesterol defined as <50 mg/dl; elevated triglycerides-to-HDL cholesterol ratio defined as ≥2 ([36] and [37]).

[b] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.

[c] CI = confidence interval calculated taking into account the complex sampling design.

[d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.

[e] Categories based on the distribution of the education data

3.5.5. Visceral/central obesity

Nearly 50 per cent of women display visceral or central obesity, and visceral or central obesity is significantly associated with age group, region, wealth quintile, marital status and smoking status (Table 33). The proportion of women with visceral/central obesity steadily increases with age and is present in more than 50 per cent of women 30–39 years of age and more than 60 per cent of women 40–49 years of age. More than 60 per cent of women in the northern region display visceral/central obesity, compared to about 40 per cent of women in the other regions. The proportion with obesity exceeds 50 per cent in women in the lowest two wealth quintiles. While the lowest proportion was found among women in the highest wealth quintile, it is nonetheless present in nearly 40 per cent of the women in that sub-group. Women who were “never married” have markedly lower proportions of visceral/central obesity, but this is likely due to the relatively young age of these women (see Section 3.4.1). Visceral/central obesity is also slightly more common among smokers compared to non-smokers.

3.5.6. Hypertension

Approximately 15 per cent of non-pregnant women are hypertensive (see Table 34). The prevalence of hypertension is significantly associated with age. Few women 15–29 years are hypertensive, and hypertension in women 40–49 years of age is most concerning as it affects nearly one quarter of all women in this age group. Significant differences are also found by residence and region, with higher prevalences found in women in rural areas and women from the northern and southern regions. The prevalence of hypertension is also significantly higher among women with lower educational attainment. Marital status is also associated with hypertension, but this relationship is likely to be due to the strong correlation between age and marital status (see Section 3.4.1).

Table 33. Prevalence of visceral/central obesity in non-pregnant women 15–49 years of age, by various demographic characteristics, Montenegro 2022

Characteristic	N	% with visceral/central obesity [a, b]	[95% CI] [c]	p-value [d]
Age group (in years)				<0.001
15–19	153	17.1	[11.9, 24.1]	
20–29	322	32.2	[26.4, 38.7]	
30–39	568	51.2	[46.4, 55.9]	
40–49	586	63.4	[58.3, 68.3]	
Residence				0.082
Urban	970	45.8	[41.4, 50.2]	
Rural	659	52.6	[46.4, 58.7]	
Region				<0.001
South	517	43.9	[37.3, 50.8]	
Centre	738	44.2	[38.9, 49.6]	
North	374	60.4	[56.0, 64.7]	
Wealth quintile				<0.001
Lowest	326	56.2	[51.0, 61.2]	
Second	321	55.1	[49.2, 60.9]	
Middle	346	43.8	[37.1, 50.6]	
Fourth	315	47.0	[40.6, 53.5]	
Highest	321	38.5	[31.6, 45.9]	
Educational attainment [e]				0.703
Lower attainment	250	47.4	[41.8, 53.1]	
Higher attainment	1379	48.7	[44.9, 52.5]	
Working activity				0.751
No paid work	940	48.1	[44.5, 51.7]	
Unskilled labour	207	51.2	[43.4, 58.9]	
Skilled labour/own business	482	48.2	[42.3, 54.1]	
Marital status				<0.001
Never married	457	26.8	[22.3, 31.8]	
Legally married/living together	1105	57.4	[53.5, 61.1]	
Divorced/separated/widowed	67	52.2	[39.0, 65.1]	
Tobacco smoking				0.016
No	1182	46.6	[43.0, 50.1]	
Yes	444	53.8	[48.0, 59.5]	
Currently breastfeeding				0.095
No	1555	48.1	[44.5, 51.6]	
Yes	74	57.0	[46.8, 66.7]	
TOTAL	1629	48.5	[45.1, 51.9]	

Note: The N numbers are the denominators for a specific sub-group. Sub-groups that do not sum to the total have missing data.

[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.

[b] Visceral/central obesity defined as waist circumference ≥80 cm.

[c] CI = confidence interval calculated taking into account the complex sampling design.

[d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.

[e] Categories based on the distribution of the education data.

Table 34. Prevalence of hypertension in non-pregnant women 15–49 years of age, by various demographic characteristics, Montenegro 2022

Characteristic	N	% with hypertension [a, b]	[95% CI] [c]	p-value [d]
Age group (in years)				<0.001
15–19	153	5.2	[2.5, 10.2]	
20–29	322	6.9	[4.5, 10.4]	
30–39	568	12.5	[9.8, 15.8]	
40–49	586	23.8	[20.6, 27.4]	
Residence				0.048
Urban	970	13.2	[11.2, 15.3]	
Rural	659	17.0	[13.9, 20.8]	
Region				0.012
South	517	17.0	[13.3, 21.5]	
Centre	738	11.9	[9.7, 14.5]	
North	374	17.6	[14.5, 21.3]	
Wealth quintile				0.441
Lowest	326	16.5	[12.8, 21.0]	
Second	321	16.9	[13.3, 21.4]	
Middle	346	12.5	[9.3, 16.6]	
Fourth	315	13.7	[10.0, 18.6]	
Highest	321	13.5	[9.8, 18.3]	
Educational attainment [e]				0.019
Lower attainment	250	19.9	[14.9, 26.0]	
Higher attainment	1379	13.7	[11.9, 15.6]	
Working activity				0.786
No paid work	940	15.0	[12.6, 17.9]	
Unskilled labour	207	15.4	[11.6, 20.2]	
Skilled labour/own business	482	13.8	[10.9, 17.3]	
Marital status				0.001
Never married	457	9.8	[7.5, 12.7]	
Legally married/living together	1105	16.5	[14.3, 18.9]	
Divorced/separated/widowed	67	19.9	[12.4, 30.3]	
Tobacco smoking				0.239
No	1182	14.0	[12.1, 16.3]	
Yes	444	16.3	[13.2, 19.9]	
Currently breastfeeding				0.329
No	1555	14.9	[13.1, 16.8]	
Yes	74	11.1	[5.9, 19.8]	
TOTAL	1629	14.7	[13.0, 16.6]	

Note: The N numbers are the denominators for a specific sub-group. Sub-groups that do not sum to the total have missing data.

[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.

[b] Hypertension defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg.

[c] CI = confidence interval calculated taking into account the complex sampling design.

[d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.

[e] Categories based on the distribution of the education data.

3.5.7. Metabolic syndrome

As shown in Table 35, more than 10 per cent of non-pregnant women have metabolic syndrome, or at least three out of five conditions (visceral obesity, diabetes, elevated triglycerides, low HDL cholesterol, hypertension) that indicate poor metabolic health. Metabolic syndrome is significantly associated with age, residence, region, wealth quintile, education status, marital status and smoking status. The prevalence consistently increases with age and is low among women younger than 30 years of age and reaches a prevalence of approximately 10 per cent and 19 per cent in women 30–39 and 40–49 years of age, respectively. The prevalence is also significantly higher in women residing in rural areas and women in the northern region. In relation to household wealth, the highest prevalence was found in women living in households from the lowest two wealth quintiles. Metabolic syndrome is also more common among women with lower educational attainment, and among women that are either divorced, separated or widowed. The prevalence of metabolic syndrome is also higher among smokers than non-smokers.

The associations between the five components of metabolic syndrome are all highly significant and positive (Table 36). Even diabetes, which is rare in Montenegro, displays a significantly higher prevalence in women with another condition (e.g. hypertension, low HDL). Moreover, diabetic women display the highest prevalences of elevated triglycerides, low HDL cholesterol, hypertension, and central/visceral obesity. The prevalence of visceral/central obesity is consistently highest among women with another condition, and ranges from 64 per cent in women with low HDL cholesterol to 91 per cent in diabetic women.

Table 35. Prevalence of metabolic syndrome in non-pregnant women 15–49 years of age, by various demographic characteristics, Montenegro 2022

Characteristic	N	% with metabolic syndrome [a, b]	[95% CI] [c]	p-value [d]
Age group (in years)				<0.001
15–19	151	2.1	[0.7, 6.5]	
20–29	318	5.0	[3.1, 7.9]	
30–39	561	9.9	[7.7, 12.7]	
40–49	576	18.8	[15.7, 22.3]	
Residence				0.006
Urban	957	9.2	[7.5, 11.4]	
Rural	649	14.6	[11.5, 18.3]	
Region				<0.001
South	517	11.8	[8.7, 15.9]	
Centre	723	7.6	[5.7, 10.1]	
North	366	17.8	[14.6, 21.5]	
Wealth quintile				0.002
Lowest	316	16.1	[12.2, 20.8]	
Second	315	14.5	[10.3, 19.8]	
Middle	343	8.2	[5.2, 12.7]	
Fourth	313	11.1	[8.3, 14.7]	
Highest	319	6.1	[3.9, 9.6]	
Educational attainment [e]				<0.001
Lower attainment	247	18.3	[13.5, 24.2]	
Higher attainment	1359	10.0	[8.4, 11.8]	
Working activity				0.630
No paid work	922	12.0	[9.9, 14.5]	
Unskilled labour	205	9.9	[6.3, 15.2]	
Skilled labour/own business	479	10.7	[8.1, 14.1]	
Marital status				<0.001
Never married	453	5.0	[3.4, 7.1]	
Legally married/living together	1087	13.6	[11.6, 15.9]	
Divorced/separated/widowed	66	18.7	[10.6, 30.8]	
Tobacco smoking				<0.001
No	1167	9.4	[7.7, 11.4]	
Yes	436	16.5	[13.0, 20.7]	
Currently breastfeeding				0.507
No	1534	11.5	[9.8, 13.4]	
Yes	72	9.1	[4.4, 17.8]	
TOTAL	1606	11.4	[9.7, 13.2]	

Note: The N numbers are the denominators for a specific sub-group. Sub-groups that do not sum to the total have missing data.
[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.
[b] Metabolic syndrome defined as at least three out of the following conditions: waist circumference ≥80 cm; diabetes as HbA1c ≥6.5%; triglycerides ≥150 mg/dl in fasting women and ≥200 mg/dl in non-fasting women; HDL cholesterol <50 mg/dl; hypertension (systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg).
[c] CI = confidence interval calculated taking into account the complex sampling design.
[d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.
[e] Categories based on the distribution of the education data.

Table 36. Internal association between components of metabolic syndrome in non-pregnant women 15–49 years of age, Montenegro 2022

	Diabetes [a]			Elevated triglycerides [b]			Low HDL cholesterol [c]			Hypertension [d]			Central/visceral obesity [e]		
	N	% [f]	p-value [g]	N	% [f]	p-value [g]	N	% [f]	p-value [g]	N	% [f]	p-value [g]	N	% [f]	p-value [g]
Diabetes [a]						<0.001			0.004			<0.001			0.007
No				1609	13.6		1605	30.2		1615	14.4		1615	48.2	
Yes				9	64.1		9	77.3		9	64.1		9	90.6	
Elevated triglycerides [b]			<0.001						<0.001			<0.001			<0.001
No	1397	0.2					1388	24.2		1397	11.5		1397	43.6	
Yes	221	2.3					220	68.5		221	33.1		221	77.2	
Low HDL cholesterol [c]			0.004			<0.001						<0.001			<0.001
No	1131	0.2		1127	6.3					1132	12.5		1132	40.5	
Yes	483	1.3		481	31.3					482	19.3		482	66.4	
Hypertension [d]			<0.001			<0.001			<0.001						<0.001
No	1383	0.2		1380	10.9		1376	28.6					1387	44.2	
Yes	241	2.2		238	31.6		238	40.2					242	73.2	
Central/visceral obesity [e]			0.007			<0.001			<0.001			<0.001			
No	849	0.1		847	6.1		844	19.8		850	7.6				
Yes	775	0.9		771	22.2		770	41.6		779	22.2				

Note: The N numbers are the denominators for a specific sub-group.

[a] Diabetes defined as HbA1c ≥6.5%.

[b] Elevated triglycerides ≥150mg/dL in fasting women and ≥200 mg/dL in non-fasting women.

[c] Low HDL cholesterol <50 mg/dL.

[d] Hypertension as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg.

[e] Central/visceral obesity as waist circumference ≥80 cm.

[f] Percentages weighted for unequal probability of selection among regions.

[g] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

3.5.8. Inflammation

Approximately 11 per cent of non-pregnant women have any inflammation, and a statistically significant association between inflammation and current breastfeeding is observed. Specifically, the inflammation prevalence among women that were breastfeeding at the time of the survey (22%) was double that of non-breastfeeding women (11%). No significant associations with other demographic indicators were found.

An examination by inflammation category revealed that incubation, early convalescent, and late convalescent inflammation occurs in 3.4 per cent, 2.9 per cent and 5.3 per cent of non-pregnant women, respectively (Figure 8). Inflammation categories are significantly associated with age group and whether they are currently breastfeeding. While the prevalence of inflammation for specific categories is generally low, late convalescent inflammation was found in fewer than 10 per cent of breastfeeding women.

Table 37. Prevalence of any inflammation in non-pregnant women 15–49 years of age, by various demographic characteristics, Montenegro 2022

Characteristic	N	% with any inflammation [a, b]	[95% CI] [c]	p-value [d]
Age group (in years)				0.281
15–19	151	9.4	[5.5, 15.4]	
20–29	318	13.2	[10.0, 17.3]	
30–39	561	12.8	[10.1, 16.0]	
40–49	572	9.9	[7.4, 13.0]	
Residence				0.596
Urban	956	11.9	[9.7, 14.5]	
Rural	646	10.9	[8.4, 14.0]	
Region				0.245
South	510	13.9	[10.9, 17.6]	
Centre	728	10.6	[8.3, 13.4]	
North	364	11.0	[7.9, 15.1]	
Wealth quintile				0.592
Lowest	317	11.8	[8.7, 15.7]	
Second	317	11.2	[8.1, 15.3]	
Middle	340	13.5	[10.1, 17.9]	
Fourth	310	9.5	[6.9, 13.1]	
Highest	318	11.1	[7.9, 15.3]	
Educational attainment [e]				0.798
Lower attainment	244	11.0	[7.7, 15.5]	
Higher attainment	1358	11.6	[9.7, 13.8]	
Working activity				0.132
No paid work	922	12.5	[10.4, 14.9]	
Unskilled labour	204	13.1	[8.7, 19.1]	
Skilled labour/own business	476	9.0	[6.6, 12.1]	
Marital status				0.530
Never married	451	10.8	[8.2, 14.0]	
Legally married/living together	1086	12.0	[10.0, 14.3]	
Divorced/separated/widowed	65	8.3	[3.8, 17.5]	

Table continued on next page

Characteristic	N	% with any inflammation [a, b]	[95% CI] [c]	p-value [d]
Tobacco smoking				0.869
No	1164	11.5	[9.7, 13.7]	
Yes	435	11.3	[8.6, 14.7]	
Currently breastfeeding				0.005
No	1529	11.0	[9.3, 12.9]	
Yes	73	22.1	[13.8, 33.5]	
TOTAL	1602	11.5	[9.8, 13.4]	

Note: The N numbers are the denominators for a specific sub-group. Sub-groups that do not sum to the total have missing data.
[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.
[b] Any inflammation defined as elevated CRP (>5 mg/L) and/or elevated AGP (>1 g/L)
[c] CI = confidence interval calculated taking into account the complex sampling design.
[d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.
[e] Categories based on the distribution of the education data.

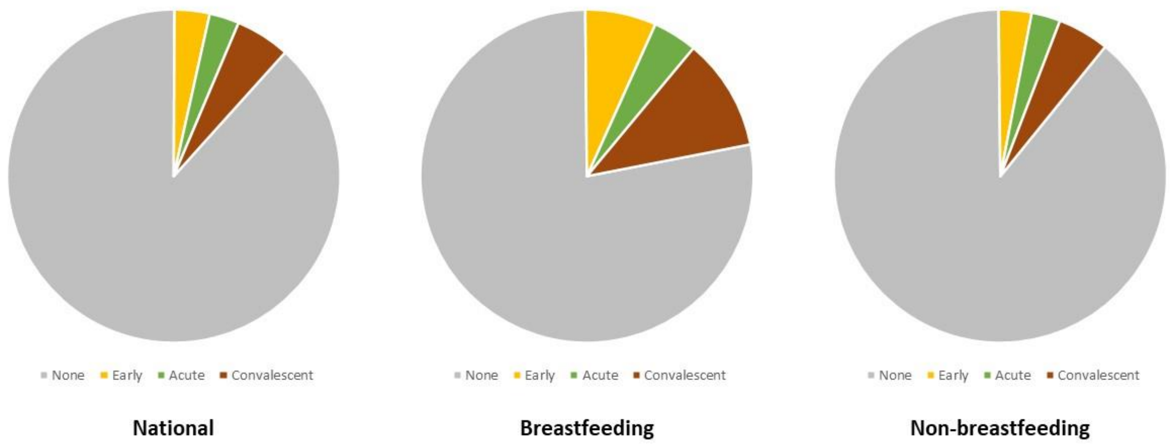

Figure 8. Inflammation categories in non-pregnant women 15–49 years of age, Montenegro 2022

3.5.9. Anaemia, iron deficiency and iron deficiency anaemia

Valid haemoglobin measurements are available for 1626 non-pregnant women and the mean and median haemoglobin concentrations are 126.0 g/L (95% CI: 125.2, 126.9; standard error = 0.4212) and 128 g/L (IQR: 119, 135), respectively (Figure 9).

Figure 10 visualizes the proportion of non-pregnant women with anaemia, iron deficiency and iron deficiency anaemia. Anaemia is present in approximately 26 per cent of women, and this prevalence denotes a “moderate” public health problem according to the WHO classification [28]. Iron deficiency is present in about 58 per cent of women. Almost all anaemia is accompanied by iron deficiency, and 23 per cent of women have iron deficiency anaemia. Among anaemic women, 89.1 per cent are deficient in iron (data not shown).

In anaemic non-pregnant women (Hb <120 g/L adjusted for altitude and smoking), approximately 57 per cent of anaemia found is classified as normocytic. In total, 42 per cent of anaemic women are microcytic, and the proportion of microcytic cases among anaemic women increases by age group from approximately 32 per cent in those 15–19 years of age to 45 per cent in those 30–39 years of age (Figure 11). Macrocytosis is highest (~4%) among women 15–19 years of age, and is less common among other age groups.

The prevalences of anaemia, iron deficiency and iron deficiency anaemia by various demographic characteristics are presented in Table 38. The prevalence of anaemia is significantly associated with age and increases consistently by age group. The anaemia prevalence is also significantly lower in women who have never been married compared to other groups, but this finding is likely to be due to the lower age of “never married” women (see Section 3.4.1). Anaemia is also significantly associated with region, with the highest prevalence found in the central region. Lastly, women who are currently breastfeeding have significantly lower anaemia prevalence compared to non-breastfeeding women.

Iron deficiency is only associated with region, and a higher proportion is found in the central region.

Iron deficiency anaemia is associated with region and marital status, with significantly higher proportions found in the central region and among those women classified as legally married or living together with their partner.

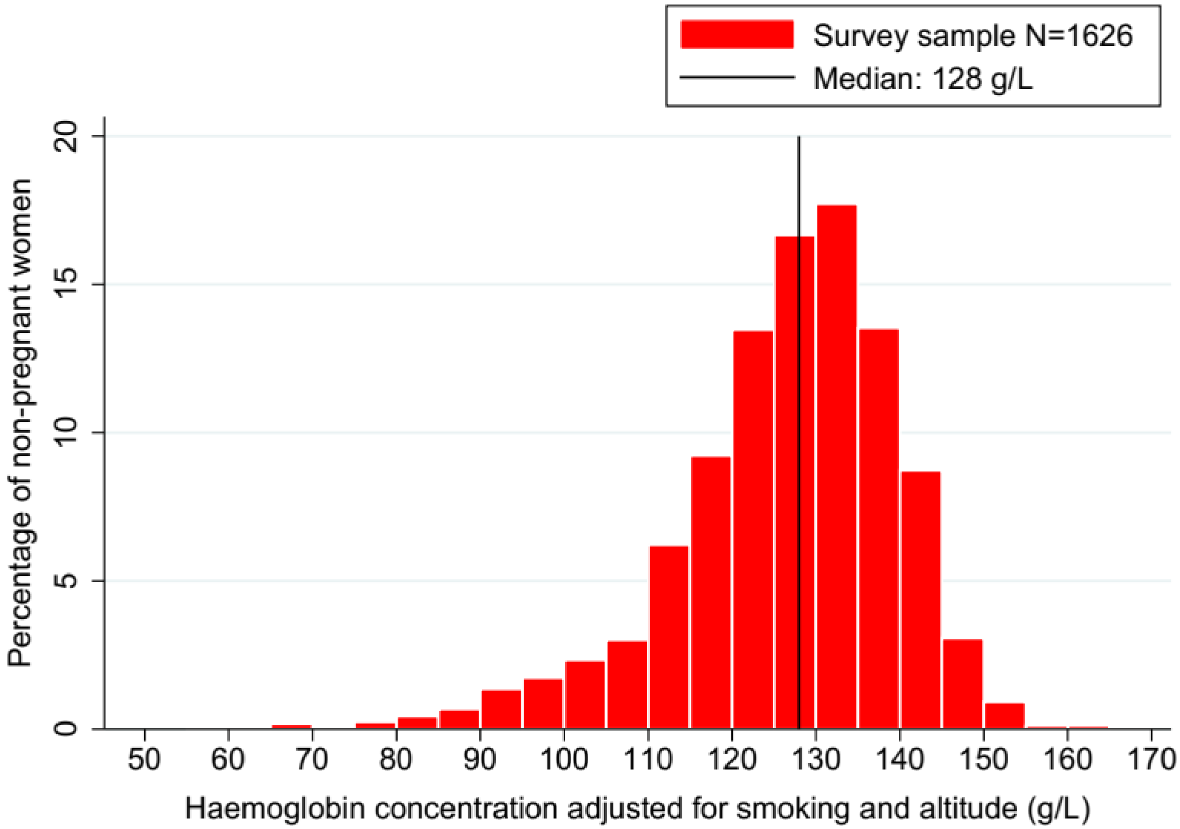

Figure 9. Distribution of adjusted haemoglobin (g/L) in non-pregnant women 15–49 years of age, Montenegro 2022

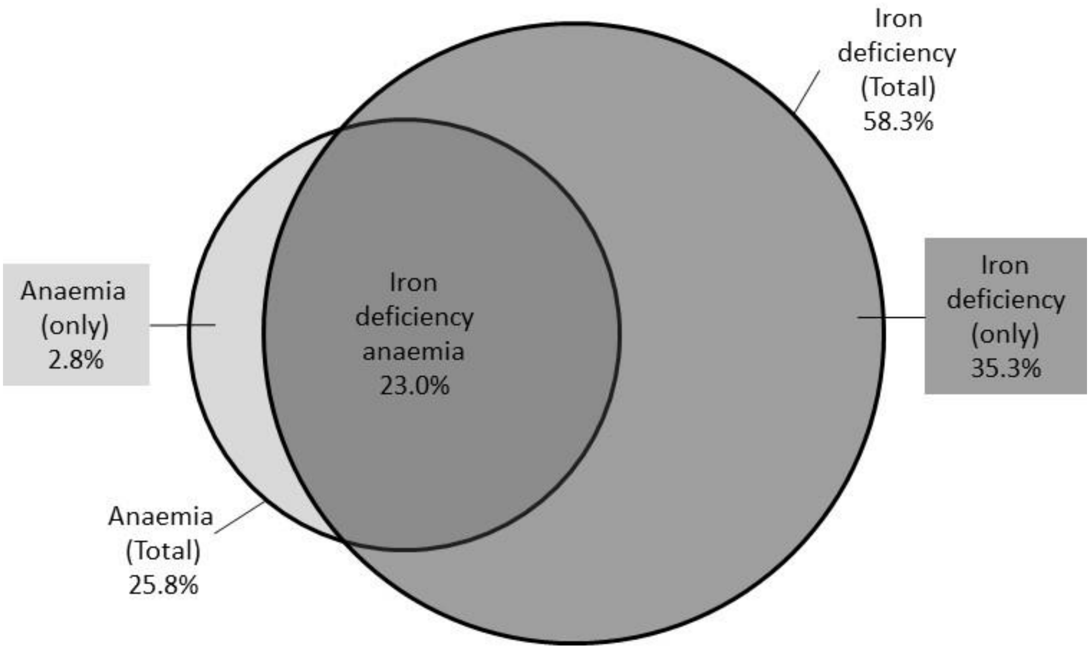

Figure 10. Venn diagram showing overlap between anaemia and iron deficiency in non-pregnant women 15–49 years of age, Montenegro 2022

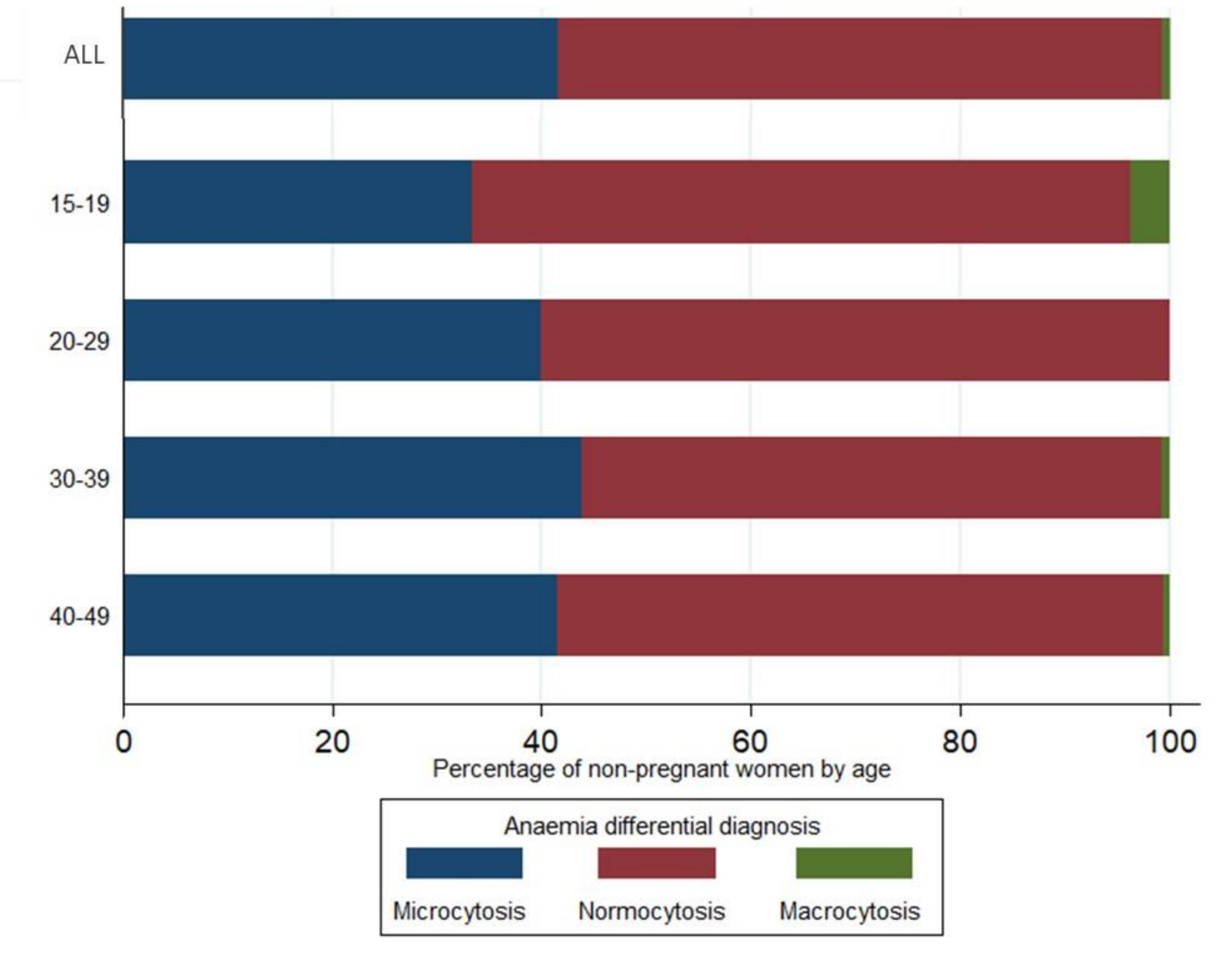

Figure 11. Anaemia type based on mean corpuscular volume (MCV) among *anaemic* non-pregnant women 15–49 years of age, by age group, Montenegro 2022

Table 38. Prevalence of anaemia, iron deficiency and iron deficiency anaemia in non-pregnant women 15–49 years of age, by various demographic characteristics, Montenegro 2022.

	Anaemia [b]				Iron deficiency [e]				Iron deficiency anaemia [f]			
Characteristic	**N**	**% [a]**	**[95% CI] [c]**	**p-value [d]**	**N**	**% [a]**	**[95% CI] [c]**	**p-value [d]**	**N**	**% [a]**	**[95% CI] [c]**	**p-value [d]**
Age group (in years)				0.032				0.812				0.120
15–19	153	17.7	[12.4, 24.5]		151	62.0	[53.3, 70.0]		151	16.5	[11.4, 23.3]	
20–29	321	22.5	[17.0, 29.2]		318	57.7	[50.9, 64.1]		317	20.2	[14.6, 27.2]	
30–39	568	26.8	[23.2, 30.6]		561	57.5	[53.3, 61.7]		560	23.7	[20.2, 27.6]	
40–49	584	29.0	[25.1, 33.1]		572	58.4	[54.7, 62.1]		571	25.5	[22.0, 29.3]	
Residence				0.801				0.789				0.473
Urban	969	25.5	[22.8, 28.5]		956	58.0	[54.4, 61.6]		955	22.2	[19.4, 25.3]	
Rural	657	26.2	[21.8, 31.2]		646	58.7	[54.9, 62.5]		644	24.1	[20.1, 28.5]	
Region				0.043				0.037				0.014
South	517	22.6	[19.4, 26.2]		510	55.5	[51.5, 59.4]		510	19.6	[16.6, 23.0]	
Centre	736	28.9	[25.3, 32.9]		728	61.5	[57.4, 65.5]		726	26.3	[22.7, 30.3]	
North	373	23.1	[18.2, 28.8]		364	54.9	[50.3, 59.5]		363	19.8	[15.6, 24.8]	
Wealth quintile				0.947				0.250				0.987
Lowest	324	25.3	[20.2, 31.1]		317	62.8	[57.2, 68.0]		315	23.9	[19.2, 29.4]	
Second	320	25.3	[20.4, 31.0]		317	57.5	[52.0, 62.8]		317	22.2	[17.5, 27.9]	
Middle	346	27.1	[21.9, 32.9]		340	59.3	[53.6, 64.8]		339	23.4	[18.7, 28.8]	
Fourth	315	24.5	[19.4, 30.5]		310	57.2	[51.1, 63.2]		310	22.5	[17.4, 28.6]	
Highest	321	27.0	[22.7, 31.7]		318	53.6	[47.4, 59.7]		318	22.5	[18.5, 27.1]	
Educational attainment [g]				0.066				0.637				0.153
Lower attainment	250	21.4	[17.0, 26.7]		244	59.8	[53.1, 66.1]		244	19.5	[15.2, 24.8]	
Higher attainment	1376	26.7	[24.0, 29.5]		1358	58.0	[55.0, 61.0]		1355	23.6	[21.1, 26.4]	
Working activity				0.324				0.533				0.700
No paid work	937	24.7	[21.6, 28.1]		922	59.4	[56.1, 62.7]		920	22.7	[19.7, 25.9]	
Unskilled labour	206	24.6	[18.6, 31.8]		204	57.9	[50.8, 64.7]		203	21.2	[15.6, 28.3]	
Skilled labour/own business	483	28.5	[24.5, 32.9]		476	56.3	[51.2, 61.1]		476	24.2	[20.3, 28.7]	

Table continued on next page

	Anaemia [b]				Iron deficiency [e]				Iron deficiency anaemia [f]			
Characteristic	**N**	**% [a]**	**[95% CI] [c]**	**p-value [d]**	**N**	**% [a]**	**[95% CI] [c]**	**p-value [d]**	**N**	**% [a]**	**[95% CI] [c]**	**p-value [d]**
Marital status				<0.001				0.539				0.003
Never married	457	18.9	[15.4, 23.1]		451	55.9	[50.0, 61.6]		451	17.3	[13.9, 21.4]	
Legally married/living together	1102	28.9	[26.0, 32.0]		1086	59.2	[56.2, 62.2]		1083	25.4	[22.6, 28.4]	
Divorced/separated/widowed	67	23.3	[14.3, 35.6]		65	60.1	[46.9, 71.9]		65	21.6	[13.0, 33.8]	
Currently breastfeeding				0.042				0.379				0.080
No	1552	26.3	[23.8, 29.0]		1529	58.6	[55.8, 61.3]		1526	23.4	[21.0, 26.0]	
Yes	74	15.4	[8.6, 25.9]		73	52.8	[40.3, 65.0]		73	14.2	[7.8, 24.5]	
TOTAL	1626	25.8	[23.4, 28.4]		1602	58.3	[55.6, 60.9]		1599	23.0	[20.6, 25.5]	

Note: The N numbers are the denominators for a specific sub-group. For iron deficiency and iron deficiency anaemia, the numbers are smaller than for anaemia due to unsuccessful blood collection (only sufficient blood could be obtained for the analysis of complete blood count, including haemoglobin concentration).

[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.

[b] Anaemia defined as haemoglobin <120 g/L; haemoglobin adjusted for altitude.

[c] CI = confidence interval calculated taking into account the complex sampling design.

[d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.

[e] Iron deficiency defined as plasma ferritin <15.0 µg/L.

[f] Iron deficiency anaemia defined as plasma ferritin <15.0 µg/L and haemoglobin <120 g/L.

[g] Categories based on the distribution of the education data.

3.5.10. Vitamin A deficiency

Vitamin A deficiency is extremely rare in non-pregnant women. Only two women are deficient in vitamin A, resulting in a prevalence of less than 1 per cent. Due to the very low prevalence, no statistically significant associations were observed.

3.5.11. Folate deficiency

Nearly 20 per cent of non-pregnant women are deficient in folate, and folate deficiency is significantly associated with age, education level, work type, marital status and breastfeeding status. Folate deficiency is highest among women 15–19 years of age and decreases consistently by age group. Folate deficiency is highest among women who have never been married, but this association is likely due to the correlation between age and marital status (see Section 3.4.1). A higher deficiency prevalence was found in women with lower educational attainment and among women without paid work. Lastly, folate deficiency among women who are currently breastfeeding is significantly higher than in non-breastfeeding women.

3.5.12. Vitamin D deficiency

As shown in Table 40, approximately 10 per cent and 33 per cent of non-pregnant women are deficient and insufficient in vitamin D, respectively, and combined vitamin D deficiency *and* insufficiency is found in 43 per cent of non-pregnant women. Combined vitamin D deficiency and insufficiency is significantly associated with region, wealth quintile and whether they are currently breastfeeding. The prevalence is highest in the northern region and affects more than 55 per cent of women in this region. The prevalence of vitamin D deficiency and insufficiency is highest among women in the lowest wealth quintile, and lowest among women in the highest wealth quintile; the prevalence in the other wealth quintiles is approximately 40 per cent.

Table 39. Prevalence of folate deficiency in non-pregnant women 15–49 years of age, by various demographic characteristics, Montenegro 2022

Characteristic	N	% with folate deficiency [a, b]	[95% CI] [c]	p-value [d]
Age group (in years)				<0.001
15–19	152	32.6	[25.0, 41.2]	
20–29	320	25.6	[20.5, 31.4]	
30–39	566	16.9	[13.7, 20.7]	
40–49	581	15.7	[12.9, 19.0]	
Residence				0.362
Urban	963	18.9	[16.1, 22.0]	
Rural	656	21.0	[17.6, 24.9]	
Region				0.672
South	514	18.1	[14.6, 22.2]	
Centre	733	20.3	[17.0, 24.1]	
North	372	20.2	[15.9, 25.3]	
Wealth quintile				0.259
Lowest	326	21.9	[16.9, 28.0]	
Second	319	22.1	[17.9, 27.0]	
Middle	343	19.1	[15.2, 23.7]	
Fourth	311	15.6	[11.9, 20.2]	
Highest	320	19.3	[15.3, 24.0]	
Educational attainment [e]				0.047
Lower attainment	249	24.6	[19.6, 30.4]	
Higher attainment	1370	18.8	[16.3, 21.5]	
Working activity				<0.001
No paid work	931	22.3	[19.3, 25.5]	
Unskilled labour	206	19.7	[15.2, 25.1]	
Skilled labour/own business	482	14.8	[12.3, 17.7]	
Marital status				0.015
Never married	454	24.2	[19.8, 29.3]	
Legally married/living together	1098	18.1	[15.9, 20.5]	
Divorced/separated/widowed	67	15.7	[8.8, 26.5]	
Currently breastfeeding				0.033
No	1545	19.3	[17.1, 21.7]	
Yes	74	28.7	[20.0, 39.4]	
TOTAL	1619	19.7	[17.5, 22.2]	

Note: The N numbers are the denominators for a specific sub-group. For folate, the numbers are smaller than for anaemia due to unsuccessful blood collection (only sufficient blood could be obtained for the analysis of complete blood count, including haemoglobin concentration) or insufficient sample volumes for folate analysis.

[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.

[b] Folate deficiency defined as plasma folate <10 nmol/L.

[c] CI = confidence interval calculated taking into account the complex sampling design.

[d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.

[e] Categories based on the distribution of the education data.

Table 40. Prevalence of vitamin D deficiency and insufficiency in non-pregnant women 15–49 years of age, by various demographic characteristics, Montenegro 2022

		Deficient [a]		Insufficient [a]		Deficient or insufficient [a]		
Characteristic	**N**	**% [b]**	**[95% CI] [c]**	**% [b]**	**[95% CI] [c]**	**% [b]**	**[95% CI] [c]**	**p-value [d]**
Age group (in years)								0.564
15–19	152	9.3	[5.5, 15.2]	28.8	[21.9, 36.7]	38.0	[30.0, 46.7]	
20–29	320	9.2	[6.3, 13.3]	33.3	[28.5, 38.5]	42.6	[37.6, 47.6]	
30–39	566	9.5	[7.5, 11.9]	34.5	[30.7, 38.6]	44.0	[39.9, 48.2]	
40–49	581	10.2	[7.7, 13.4]	32.8	[28.9, 37.0]	43.0	[38.6, 47.4]	
Residence								0.342
Urban	963	10.4	[8.2, 13.2]	31.1	[28.0, 34.4]	41.5	[37.3, 45.9]	
Rural	656	8.5	[6.3, 11.5]	36.1	[31.5, 41.1]	44.7	[40.1, 49.4]	
Region								<0.001
South	514	7.8	[5.7, 10.5]	25.9	[22.3, 29.9]	33.7	[29.9, 37.6]	
Centre	733	8.2	[6.2, 10.7]	31.5	[27.7, 35.6]	39.7	[35.3, 44.3]	
North	372	14	[10.0, 19.2]	42.5	[36.8, 48.4]	56.5	[50.5, 62.2]	
Wealth quintile								0.002
Lowest	326	12.0	[8.4, 17.0]	39.9	[33.8, 46.4]	52.0	[45.7, 58.2]	
Second	319	11.4	[7.4, 17.3]	30.3	[25.8, 35.2]	41.7	[35.7, 47.9]	
Middle	343	8.1	[5.6, 11.5]	32.0	[27.0, 37.5]	40.1	[35.5, 44.9]	
Fourth	311	8.5	[5.6, 12.7]	32.8	[27.5, 38.5]	41.3	[35.6, 47.2]	
Highest	320	7.6	[5.1, 11.2]	29.3	[24.1, 35.0]	36.9	[31.1, 43.1]	
Educational attainment [e]								0.081
Lower attainment	249	13.0	[9.1, 18.2]	34.6	[28.8, 41.0]	47.6	[41.9, 53.5]	
Higher attainment	1370	9.0	[7.3, 11.0]	32.8	[30.0, 35.8]	41.8	[38.4, 45.3]	
Working activity								0.155
No paid work	931	9.1	[6.9, 11.8]	31.9	[28.6, 35.4]	41.0	[37.3, 44.7]	
Unskilled labour	206	13.7	[9.7, 18.8]	34.5	[27.4, 42.4]	48.2	[41.5, 55.0]	
Skilled labour/own business	482	9.2	[6.8, 12.3]	34.9	[30.1, 40.0]	44.0	[38.9, 49.3]	
Marital status								0.507
Never married	454	11.8	[9.0, 15.2]	28.7	[24.4, 33.4]	40.5	[35.6, 45.6]	
Legally married/living together	1098	8.6	[6.8, 10.8]	35.0	[31.9, 38.2]	43.6	[40.0, 47.2]	
Divorced/separated/widowed	67	12.3	[6.2, 23.0]	32.9	[22.6, 45.1]	45.2	[33.5, 57.4]	
Currently breastfeeding								0.009
No	1545	9.3	[7.6, 11.2]	32.7	[30.1, 35.5]	42.0	[39.0,45.1]	
Yes	74	17.4	[10.3, 28.0]	40.7	[29.5, 52.9]	58.1	[45.8,69.5]	
TOTAL	1619	9.7	[8.0, 11.6]	33.1	[30.5, 35.9]	42.8	[39.7,45.9]	

Note: The N numbers are the denominators for a specific sub-group. For vitamin D, the numbers are smaller than for anaemia due to unsuccessful blood collection (only sufficient blood could be obtained for the analysis of complete blood count, including haemoglobin concentration) or insufficient sample volumes for vitamin D analysis.

[a] Deficient <12 ng/mL; Insufficient 12–19.9 ng/mL.

[b] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.

[c] CI = confidence interval calculated taking into account the complex sampling design.

[d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.

[e] Categories based on the distribution of the education data.

3.5.13. Associations between anaemia and micronutrient deficiencies and various factors

Anaemia in non-pregnant women is significantly associated with iron deficiency and the consumption of multivitamins or iron tablets/syrup in the previous six months (Table 41). For iron-deficient women, the anaemia prevalence is greater than 40 per cent, whereas anaemia is only found in less than 10 per cent of those that are iron-replete. Women consuming multivitamin supplements have a slightly lower anaemia prevalence than those not taking multivitamins. In contrast, the anaemia prevalence is about 25 percentage points higher among women who took iron tablets/syrup in the previous six months compared to women who did not take an iron supplement. Since 83 per cent of the women who took iron tablets/ syrup were prescribed this supplement by their doctor (see Table 29), iron supplements in Montenegro are likely used to *treat* existing anaemia rather than used as a prophylactic supplement.

Table 41. Associations between anaemia and various nutritional factors in non-pregnant women 15-49 years of age, Montenegro 2022

Characteristic	N	% [a] Anaemic	p-value [b]
Minimum dietary diversity			0.639
No	389	24.9	
Yes	1237	26.1	
Took iron tablets or syrup in previous six months			<0.001
No	1466	23.5	
Yes	156	48.2	
Took folate supplements in previous six months			0.077
No	1560	25.4	
Yes	62	36.0	
Took vitamin A tablets in previous six months			0.530
No	1606	25.9	
Yes	17	19.2	
Took multivitamin supplements in previous six months			0.041
No	1350	27.0	
Yes	276	20.2	
Took vitamin D supplements in previous six months			0.952
No	1452	25.8	
Yes	171	25.6	
Woman had inflammation			0.702
No	1411	26.1	
Yes	188	24.7	
Woman iron-deficient			<0.001
No	671	7.1	
Yes	928	39.4	
Woman folate-deficient			0.324
No	1300	25.3	
Yes	316	28.1	
Woman's vitamin D status			0.434
Normal	944	27.2	
Insufficient	520	24.1	
Deficient	152	23.8	

Note: The N numbers are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

Iron deficiency is significantly associated with the consumption of multivitamin supplements in the previous six months (Table 42). Similar to anaemia, consumption of multivitamins is associated with a lower prevalence of iron deficiency. A near-significant association was also found between iron deficiency and consumption of iron tablets/syrup, with a higher iron deficiency prevalence among those consuming iron supplements. Women that are folate-deficient also have a significantly higher prevalence of iron deficiency.

Table 42. Association between iron deficiency and various factors in non-pregnant women 15–49 years of age, Montenegro 2022

Characteristic	N	% [a] Iron-deficient	p-value [b]
Minimum dietary diversity			0.170
No	381	61.3	
Yes	1221	57.4	
Took iron tablets or syrup in previous six months			0.076
No	1443	57.7	
Yes	155	65.0	
Currently taking iron tablets or syrup			0.780
No	1528	58.5	
Yes	70	56.6	
Took folate supplements in previous six months			0.141
No	1536	58.7	
Yes	62	50.1	
Took vitamin A tablets in previous six months			0.337
No	1581	58.4	
Yes	18	46.4	
Took multivitamin supplements in previous six months			0.001
No	1331	60.2	
Yes	271	49.0	
Took vitamin D supplements in previous six months			0.506
No	1429	58.6	
Yes	170	55.6	
Woman had inflammation			0.862
No	1414	58.4	
Yes	188	57.7	
Woman folate-deficient			0.012
No	1283	56.7	
Yes	309	65.7	
Woman's vitamin D status			0.798
Normal	929	58.9	
Insufficient	515	57.4	
Deficient	148	59.8	

Note: The N numbers are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

Folate deficiency is significantly associated with minimum dietary diversity, and women with a minimum diverse diet have a lower deficiency prevalence (Table 43). Folate deficiency is also significantly associated with the consumption of either folate, multivitamin, iron or vitamin D supplements in the previous six months, with the consumption of any supplement associated with a lower prevalence of folate deficiency. Inflammation is also associated with folate deficiency, with a higher folate deficiency prevalence found in women with an inflammation.

When examining the association between vitamin D deficiency or insufficiency and nutritional factors, no significant associations are found (Table 44).

Table 43. Association between folate deficiency and various factors in non-pregnant women 15–49 years of age, Montenegro 2022

Characteristic	N	% [a] Folate-deficient	p-value [b]
Minimum dietary diversity			0.047
No	387	23.1	
Yes	1232	18.7	
Took iron tablets or syrup in previous six months			0.040
No	1459	20.5	
Yes	156	12.8	
Took folate supplements in previous six months			0.186
No	1553	20.0	
Yes	62	13.3	
Currently taking folate supplements			0.037
No	1587	20.0	
Yes	28	5.7	
Took vitamin A tablets in previous six months			0.804
No	1599	19.7	
Yes	17	17.4	
Took multivitamin supplements in previous six months			0.032
No	1346	20.9	
Yes	273	14.4	
Took vitamin D supplements in previous six months			0.025
No	1446	20.5	
Yes	170	13.6	
Woman had inflammation			0.011
No	1407	18.6	
Yes	185	26.8	

Note: The N numbers are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

Table 44. Association between vitamin D deficiency or insufficiency and various factors in non-pregnant women 15–49 years of age, Montenegro 2022

Characteristic	N	% [a] Vitamin D deficient or insufficient	p-value [b]
Minimum dietary diversity			0.905
No	387	42.5	
Yes	1232	42.8	
Took iron tablets or syrup in previous six months			0.360
No	1459	42.5	
Yes	156	46.3	
Took folate supplements in previous six months			0.926
No	1553	42.8	
Yes	62	43.4	
Took vitamin A tablets in previous six months			0.221
No	1599	43.0	
Yes	17	23.9	
Took multivitamin supplements in previous six months			0.465
No	1346	43.2	
Yes	273	40.8	
Took vitamin D supplements in previous six months			0.770
No	1446	42.7	
Yes	170	43.9	
Currently taking vitamin D supplements			0.166
No	1520	43.3	
Yes	96	35.8	
Woman had inflammation			0.635
No	1407	42.5	
Yes	185	44.5	

Note: The N numbers are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

3.5.14. Associations between components of metabolic syndrome and nutrition indicators

The association between the components of metabolic syndrome and various nutritional factors are present in Table 45. The most consistent association is found between inflammation and the components of metabolic syndrome, with the prevalence of all components higher among women with inflammation. A similarly consistent association was found between vitamin D deficiency or insufficiency: the prevalence of women with elevated triglycerides, low HDL cholesterol, or central/visceral obesity is significantly higher among vitamin-D-deficient or -insufficient women. In contrast, anaemia and iron deficiency anaemia are significantly associated with multiple components of metabolic syndrome, but the direction of the associations found are inconsistent. While the prevalence of elevated HbA1c is higher among women with anaemia or iron deficiency anaemia, the prevalence of elevated triglycerides, hypertension and visceral/central obesity are lower among those with anaemia or iron deficiency anaemia. Lastly, low HDL cholesterol is significantly higher among women with folate deficiency.

Table 45. Association between components of metabolic syndrome and nutrition indicators in non-pregnant women 15–49 years of age, Montenegro 2022

	Elevated HbA1c [a]			Elevated triglycerides [b]			Low HDL cholesterol [c]			Hypertension [d]			Central/visceral obesity [e]		
	N	% [f]	p-value [g]	N	% [f]	p-value [g]	N	% [f]	p-value [g]	N	% [f]	p-value [g]	N	% [f]	p-value [g]
Minimum dietary diversity			0.845			0.823			0.357			0.070			0.547
No	389	4.2		389	13.5		386	32.7		388	12.0		388	47.0	
Yes	1236	3.9		1230	14.0		1229	29.6		1241	15.6		1241	49.0	
Anaemia			0.004			0.010			0.256			0.013			0.003
No	1210	3.0		1206	15.2		1201	31.2		1209	16.0		1209	50.8	
Yes	415	6.7		413	10.0		414	28.1		416	10.9		416	41.5	
Iron deficiency			0.260			0.230			0.413			0.350			0.138
No	671	3.2		670	15.2		668	31.5		671	15.5		671	51.1	
Yes	927	4.5		922	12.9		921	29.3		930	13.8		930	46.9	
Iron deficiency anaemia			0.011			0.013			0.353			0.041			0.028
No	1236	3.2		1232	15.1		1228	30.8		1235	15.5		1235	50.3	
Yes	362	6.6		360	9.7		361	28.3		363	11.3		363	43.2	
Folate deficiency			0.996			0.856			0.012			0.097			0.834
No	1299	3.9		1294	13.8		1294	28.8		1302	15.3		1302	48.5	
Yes	316	3.9		315	14.3		311	37.0		316	11.5		316	47.9	
Vitamin D deficiency or insufficiency			0.996			0.002			0.013			0.793			0.037
No	944	3.9		941	11.5		936	27.6		945	14.4		945	45.9	
Yes	671	3.9		668	17.1		669	34.2		673	14.8		673	51.6	
Woman had inflammation			<0.001			0.001			<0.001			<0.001			<0.001
No	1411	3.3		1405	12.8		1401	27.6		1413	13.5		1413	46.6	
Yes	187	9.1		187	22.0		188	50.7		188	22.7		188	64.7	

Note: The N numbers are the denominators for a specific sub-group.

[a] Elevated HbA1c ≥5.7%.

[b] Elevated triglycerides ≥150mg/dL in fasting women and ≥200 mg/dL in non-fasting women.

[c] Low HDL cholesterol <50 mg/dL.

[d] Hypertension as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg.

[e] Central/visceral obesity as waist circumference ≥80 cm.

[f] Percentages weighted for unequal probability of selection among regions.

[g] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

3.5.15. Associations between metabolic syndrome and various factors

The composite measure of metabolic syndrome is significantly associated with anaemia, iron deficiency anaemia, vitamin D deficiency and inflammation (Table 46). The prevalence of metabolic syndrome is significantly higher in women with inflammation and vitamin D deficiency or insufficiency, whereas the prevalence is significantly lower in anaemic women and women with iron deficiency anaemia. The direction of the association between these factors and metabolic syndrome are similar to those observed for single cardiovascular risk factors (see Table 45).

Table 46. Association between metabolic syndrome and various factors in non-pregnant women 15–49 years of age, Montenegro 2022

Characteristic	N	% with metabolic syndrome [a, b]	p-value [c]
Minimum dietary diversity			0.921
No	385	11.2	
Yes	1221	11.4	
Anaemia			0.002
No	1196	12.9	
Yes	410	6.9	
Iron deficiency			0.119
No	667	12.9	
Yes	913	10.2	
Iron deficiency anaemia			0.004
No	1223	12.7	
Yes	357	6.7	
Folate deficiency			0.800
No	1287	11.2	
Yes	309	11.7	
Vitamin D deficiency or insufficiency			0.029
No	933	9.6	
Yes	663	13.6	
Woman had inflammation			<0.001
No	1394	9.6	
Yes	186	24.6	

Note: The N numbers are the denominators for a specific sub-group.
[a] Metabolic syndrome defined as at least three out of the following conditions: waist circumference ≥80 cm; diabetes as HbA1c ≥6.5%; triglycerides ≥150 mg/dL in fasting women and ≥200 mg/dL in non-fasting women; HDL cholesterol <50 mg/dL; systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg.
[b] Percentages weighted for unequal probability of selection among regions.
[c] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

3.5.16. Associations between sun exposure and vitamin D deficiency

Multiple practices related to dress and sun exposure can affect an individual's vitamin D status. Among Montenegrin non-pregnant women, vitamin D deficiency or insufficiency is significantly associated with the covering of arms when outside: a deficiency or insufficiency prevalence of greater than 80 per cent among women reporting that they cover their arms "all the time" when outside. The use of sunscreen is also associated with vitamin D deficiency or insufficiency, but with no observable pattern in the frequency of use. The woman's skin colour is also associated with vitamin D status, with the highest deficiency or insufficiency prevalence in women who have very white or white skin. The sun exposure index is also associated with vitamin D status, but surprisingly, the lowest prevalence (~40%) is found in women with the highest and lowest levels of sun exposure.

Table 47. Association between vitamin D deficiency or insufficiency and sun exposure indicators in non-pregnant women 15–49 years of age, Montenegro 2022

Characteristic	N	%[a] Deficient	%[a] Insufficient	% [a] Deficient or insufficient	p-value [b]
Usually protects head from sun when outside					0.126
Never/rarely	1254	10.2	33.8	44.0	
Sometimes	266	4.2	30.3	34.5	
Most of the time	58	11.6	35.1	46.7	
All the time	41	25.0	25.4	50.4	
How she protects head from sun when outside					0.310
Scarf/headcloth	52	24.1	23.4	47.5	
Hat	312	4.9	31.9	36.7	
Umbrella	1	0	0	0	
Usually covers arms when outside					0.013
Never/rarely	1559	9.3	33.2	42.6	
Sometimes	39	2.6	33.0	35.6	
Most of the time	6	0	33.3	33.3	
All the time	15	62.5	21.3	83.8	
Usually covers hands when outside					0.639
Never/rarely	1599	9.6	33.3	42.9	
Sometimes	11	21.0	17.3	38.3	
Most of the time	3	0	0	0	
All the time	6	13.6	19.2	32.8	
Approximate daily time spent under the sun					0.057
None	32	5.8	51.2	57.0	
1–29 minutes	204	13.4	32.7	46.1	
30–59 minutes	305	13.6	34.8	48.4	
1–2 hours	598	9.5	32.7	42.2	
2–3 hours	370	6.7	30.9	37.6	
>3 hours	104	3.2	32.8	36.0	
Usually uses sunscreen					0.003
Never/rarely	954	11.5	34.9	46.4	
Sometimes	476	6.6	29.2	35.8	
Most of the time	131	8.4	35.1	43.5	
All the time	58	5.6	29.4	35.0	
Respondent skin colour					0.032
Very white/white	707	11.1	35.8	46.9	
Olive	717	9.1	30.7	39.8	
Dark/very dark	193	6.6	31.3	37.9	
Sun exposure index					0.027
20+	874	7.2	31.8	39.1	
10–19.9	316	12.7	34.2	46.9	
0.01–9.9	340	14.2	34.5	48.7	
0	83	5.1	35.8	40.9	

Note: The N numbers are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

3.6. Pregnant women

3.6.1. Consumption of mineral and vitamin supplements

As shown in Table 48, iron and folic acid supplements are the single-nutrient supplements most commonly consumed by pregnant women; approximately 33 per cent and 54 per cent of pregnant women reported consuming iron and folic acid supplements, respectively, in the previous six months. Nearly 12 per cent of pregnant women reported consuming vitamin D supplements in the previous six months, whereas consumption of vitamin B12 or vitamin A supplements was reported by fewer than 10 per cent of pregnant women. The consumption of multivitamin supplements in the previous six months is common and reported by nearly 42 per cent of pregnant women.

Among pregnant women who report having consumed iron or folic acid supplements, most were still taking the supplement at the time of the survey. Among pregnant women who report having consumed vitamin D or multivitamins in the previous six months, the proportion that were still taking these supplements at the time of the survey was greater than 70 per cent. In contrast, only 46 per cent and 21 per cent of pregnant women who reported having consumed vitamin A and vitamin B12, respectively, were still taking these supplements at the time of the survey.

Nearly all of the women taking supplements of any kind in the previous six months reported that their doctor prescribed these supplements.

The consumption of medication for the treatment or prevention of intestinal parasites is not practised by any pregnant women.

Table 48. Consumption of mineral and vitamin supplements and drug for intestinal worms in pregnant women, Montenegro 2022

Characteristic	N	% [a]	[95% CI] [b]
Took iron tablets or syrup in previous six months			
No	43	67.0	[53.2, 78.4]
Yes	22	33.0	[21.6, 46.8]
Don't know	0	0	-
Is still taking iron [c]			
No	3	14.8	[5.2, 35.9]
Yes	19	85.2	[64.1, 94.8]
Iron prescribed by a doctor [c]			
No	1	5.4	[0.7, 30.4]
Yes	21	94.6	[69.6, 99.3]
Took folic acid supplements in previous six months			
No	29	46.3	[35.1, 57.8]
Yes	36	53.7	[42.2, 64.9]
Don’t know	0	0	-
Is still taking folic acid [c]			
No	8	21.7	[10.1, 40.5]
Yes	28	78.3	[59.5, 89.9]

Table continued on next page

Characteristic	N	% [a]	[95% CI] [b]
Folic acid prescribed by a doctor [c]			
No	1	2.2	[0.3, 14.2]
Yes	35	97.8	[85.8, 99.7]
Took vitamin D tablets, syrup or spray in previous six months			
No	56	86.7	[76.9, 92.8]
Yes	8	11.7	[5.9, 21.7]
Don't know	1	1.6	[0.2, 10.4]
Is still taking vitamin D [c]			
No	2	28.1	[7.1, 66.6]
Yes	6	71.9	[33.4, 92.9]
Vitamin D prescribed by a doctor [c]			
No	0	0	-
Yes	8	100	-
Took vitamin A tablets or other preparations in previous six months			
No	61	93.9	[84.9, 97.7]
Yes	4	6.1	[2.3, 15.1]
Don't know	0	0	-
Is still taking vitamin A [c]			
No	2	53.9	[13.6, 89.7]
Yes	2	46.1	[10.3, 86.4]
Vitamin A prescribed by a doctor [c]			
No	0	0	-
Yes	4	100	-
Took multivitamin tablets or other preparations in previous six months			
No	38	58.2	[44.6, 70.7]
Yes	27	41.8	[29.3, 55.4]
Don't know	0	0	-
Is still taking multivitamins [c]			
No	4	16.0	[6.2, 35.3]
Yes	23	84.0	[64.7, 93.8]
Multivitamins prescribed by a doctor [c]			
No	1	3.9	[0.5, 23.7]
Yes	26	96.1	[76.3, 99.5]
Took vitamin B12 supplements or received vitamin B12 injections in previous six months			
No	59	91.1	[81.6, 96.0]
Yes	5	7.7	[3.3, 17.1]
Don't know	1	1.2	[0.2, 8.0]
Is still taking vitamin B12 supplements or receiving vitamin B12 injections [c]			
No	4	78.8	[28.3, 97.2]
Yes	1	21.2	[2.8, 71.7]
Vitamin B12 prescribed by a doctor [c]			
No	0	0	-
Yes	5	100	-

Characteristic	N	% [a]	[95% CI] [b]
Table continued from previous page			
Took drug for intestinal worms in previous six months			
No	65	100	-
Yes	0	0	-
Drug for intestinal worms prescribed by a doctor [c]			
No	0	0	-
Yes	0	0	-

Note: The N numbers are the numerators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection among regions.
[b] CI = confidence interval calculated taking into account the complex sampling design.
[c] Only includes women responding "Yes" to taking the respective supplement/tablet/syrup/preparation/injection/drug.

3.6.2. Sun exposure

As shown in

Table 49, approximately 25 per cent of pregnant women report covering their head at times when outside, with more than 10 per cent covering their head "most of the time" or "all the time". In contrast, coverage of arms and hands when outside is practised infrequently. About 40 per cent of women reported using sunscreen with more than 10 per cent reporting using it "most of the time" or "all the time". Approximately 60 per cent of women have one hour or more of direct sun exposure per day. Approximately 44 per cent of pregnant women use sunscreen "sometimes", "most of the time" or "all the time". The sun exposure index shows high index scores (i.e. ≥20) for nearly 47 per cent of women.

Table 49. Sun exposure patterns in pregnant women, Montenegro 2022

Characteristic	N	% [a]	[95% CI] [b]
Usually protects head from sun when outside			
Never/rarely	49	76.3	[60.2, 87.2]
Sometimes	9	13.4	[5.9, 27.9]
Most of the time	1	1.2	[0.2, 8.0]
All the time	6	9.1	[4.3, 18.6]
How she protects head from sun when outside [c]			
Scarf/headcloth	3	19.3	[5.4, 49.7]
Hat	13	80.7	[50.3, 94.6]
Umbrella	0	0	-
Blanket	0	0	-
Usually covers arms when outside			
Never/rarely	58	89.4	[74.2, 96.1]
Sometimes	5	7.7	[2.1, 24.5]
Most of the time	1	1.2	[0.2, 8.0]
All the time	1	1.8	[0.2, 11.8]
Usually covers hands when outside			
Never/rarely	63	97.7	[91.0, 99.4]
Sometimes	2	2.3	[0.6, 9.0]
Most of the time	0	0	-
All the time	0	0	-

Characteristic	N	% [a]	[95% CI] [b]
Table continued on next page			
Direct sun exposure during [d]			
Walking to bus/taxi	45	69.4	[54.1, 81.4]
Walking to market and/or work	55	84.2	[73.3, 91.2]
Working outside	33	51.9	[38.0, 65.5]
Watching children outside	39	62.0	[50.2, 72.6]
Doing household duties outside	27	44.0	[31.5, 57.2]
Sunbathing	3	4.4	[1.4, 12.9]
Strolling	0	0	-
Sport	0	0	-
Approximate daily time spent in the sun			
None	1	1.6	[0.2, 10.4]
1–29 minutes	7	10.5	[4.8, 21.5]
30–59 minutes	17	27.3	[18.1, 38.9]
1–2 hours	22	34.1	[23.7, 46.3]
2–3 hours	14	19.7	[11.5, 31.5]
>3 hours	4	6.8	[2.5, 17.0]
Usually uses sunscreen			
Never/rarely	35	56.4	[42.1, 69.7]
Sometimes	17	25.1	[15.5, 37.9]
Most of the time	10	14.1	[6.3, 28.8]
All the time	3	4.4	[1.5, 12.4]
Respondent skin colour			
Very white	2	2.8	[0.7, 10.4]
White	28	43.3	[30.5, 57.1]
Olive	31	47.4	[33.5, 61.6]
Dark	4	6.5	[2.6, 15.7]
Very dark	0	0	-
Unable to observe	0	0	-
Sun exposure index			
20+	30	46.8	[33.7, 60.3]
10–19.9	15	24.0	[15.3, 35.6]
0.01–9.9	16	23.1	[13.6, 36.5]
0	4	6.1	[2.5, 14.1]

Note: The N numbers are the numerators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection among regions.
[b] CI = confidence interval calculated taking into account the complex sampling design.
[c] Only includes women protecting their head sometimes, most of the time or all the time.
[d] Multiple answers possible.

3.6.3. Components of metabolic syndrome

As noted in Section 2.7.2, the prevalence of metabolic syndrome could not be calculated for pregnant women as central/visceral obesity could not be measured. Nonetheless, most of the components of metabolic syndrome can be explored.

Among all pregnant women, elevated triglycerides and an elevated triglyceride/HDL ratio are the most common metabolic conditions. Other indicators (i.e. elevated HbA1c, hypertension, low HDL cholesterol) are found in fewer than 10 per cent of pregnant women (Table 50). Despite the relatively high prevalence for elevated triglycerides and an elevated triglyceride/HDL ratio, only about 13 per cent of pregnant women have two or more concurrent conditions.

Sub-group analysis by trimester shows a significant association between trimester and elevated triglycerides, an elevated triglyceride/HDL ratio and the number of concurrent conditions. The prevalence of both elevated triglycerides and an elevated triglyceride/HDL ratio increases consistently by trimester, and each affect more than 90 per cent of pregnant women in their third trimester. Similarly, the proportion of women with two concurrent conditions also increases by trimester, with more than 75 per cent of women in their third trimester having at least two concurrent conditions.

Table 50. Prevalence of diabetes, pre-diabetes and elevated HbA1c; elevated triglycerides, low HDL cholesterol and an elevated triglyceride/HDL cholesterol ratio; hypertension; and metabolic syndrome in pregnant women, by trimester of pregnancy, Montenegro 2022

	All trimesters [a]			1st trimester [a]			2nd trimester [a]			3rd trimester [a]			
	N	% [b]	[95% CI] [c]	N	% [b]	[95% CI] [c]	N	% [b]	[95% CI] [c]	N	% [b]	[95% CI] [c]	p-value [d]
Elevated HbA1c [e]													0.222
Diabetes	64	0	-	10	0	-	28	0	-	26	0	-	
Pre-diabetes	64	2.8	[0.7, 11.3]	10	0	-	28	0	-	26	7.4	[1.7, 26.8]	
Elevated triglycerides [f]	62	44.7	[30.7, 59.6]	10	11.6	[1.5, 53.1]	27	31.3	[15.3, 53.4]	25	75.0	[52.9, 88.9]	0.002
Low HDL [g]	63	7.9	[3.3, 18.0]	10	19.1	[4.3, 55.2]	27	4.1	[0.5, 25.5]	26	7.8	[1.7, 28.5]	0.370
Elevated triglyceride/HDL ratio [h]	61	63.4	[49.9, 75.2]	10	41.4	[15.6, 73.0]	26	47.8	[29.7, 66.4]	25	90.9	[68.8, 97.9]	0.004
Hypertension [i]	64	9.3	[4.1, 19.8]	10	0	-	28	7.9	[2.0, 27.0]	26	14.8	[5.4, 34.4]	0.380
Number of concurrent conditions [j]													0.002
0	61	46.4	[32.6, 60.8]	10	69.3	[35.8, 90.1]	26	67.2	[45.1, 83.6]	25	12.7	[3.7, 35.3]	
1	61	45.4	[31.4, 60.2]	10	30.7	[9.9, 64.2]	26	24.3	[10.1, 47.9]	25	76.0	[53.3, 89.7]	
2	61	8.2	[3.4, 18.7]	10	0	-	26	8.6	[2.1, 28.8]	25	11.4	[3.4, 32.1]	

[a] The N numbers are the denominators for all trimesters or specific for each trimester.
[b] Percentages weighted for unequal probability of selection among regions.
[c] CI = confidence interval calculated taking into account the complex sampling design.
[d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.
[e] Diabetes defined as glycated haemoglobin (HbA1c) ≥6.5%; pre-diabetes defined as HbA1c ≥5.7% to <6.5%.
[f] Elevated triglycerides defined as ≥150 mg/dL in fasting women and ≥200 mg/dL in non-fasting women.
[g] Low HDL cholesterol defined as <50 mg/dL.
[h] Elevated triglycerides-to-HDL cholesterol ratio defined as ≥2.
[i] Hypertension defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg.
[j] Pre-diabetes and an elevated triglyceride/HDL ratio were not used when identifying concurrent conditions.

3.6.4. Anaemia

As shown in Table 51, nearly 30 per cent of pregnant women are anaemic. Significant differences in anaemia prevalence are found only according to the trimester of pregnancy, with no anaemia among pregnant women in their first trimester and an increasing prevalence in the second and third trimesters. Crucially, more than 50 per cent of pregnant women in their third trimester are anaemic.

Figure 12 shows that the haemoglobin concentration in pregnant women is normally distributed, and that the median haemoglobin is 116.5 g/L (IQR: 109,123). The mean haemoglobin among pregnant women is 114.6 g/L (95% CI: 111.8, 117.5; standard error = 1.4).

In anaemic pregnant women, 18.3 per cent, 77.7 per cent and 4.0 per cent are classified as microcytic, normocytic and macrocytic, respectively (Figure 13). While the prevalence of microcytosis is similar in the 20–29-year and 30–39-year age groups, macrocytosis (6.5%) is only found in women 30–39 years of age.

Table 51. Prevalence of anaemia in pregnant women, by various demographic characteristics, Montenegro 2022

Characteristic	N	%[a, b]	[95% CI] [c]	p-value [d]
Age (in years)				0.808
20–29	23	27.6	[12.7, 49.9]	
30–39	39	29.9	[17.1, 46.9]	
40+	2	50.0	[5.6, 94.4]	
Residence				0.546
Urban	32	33.3	[18.6, 52.2]	
Rural	32	26.3	[14.3, 43.3]	
Region				0.144
South	18	11.1	[3.1, 32.6]	
Centre	31	35.5	[21.1, 53.1]	
North	15	33.3	[14.4, 59.8]	
Wealth quintile				0.771
Lowest	12	25.8	[8.4, 56.8]	
Second	9	24.3	[6.9, 58.3]	
Middle	18	22.7	[7.2, 52.7]	
Fourth	12	35.0	[15.9, 60.7]	
Highest	13	43.5	[19.1, 71.4]	
Educational attainment [e]				0.831
Lower attainment	4	25.0	[3.2, 76.9]	
Higher attainment	60	30.1	[19.8, 43.0]	
Trimester of pregnancy				0.009
1	10	0	-	
2	28	22.4	[10.5, 41.7]	
3	26	50.5	[31.1, 69.8]	
TOTAL	64	29.7	[19.7, 42.2]	

Note: The N numbers are the denominators for a specific sub-group. [a] Anaemia defined as haemoglobin <110 g/L adjusted for altitude. [b] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions. [c] CI = confidence interval calculated taking into account the complex sampling design. [d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others. [e] Categories based on the distribution of the education data

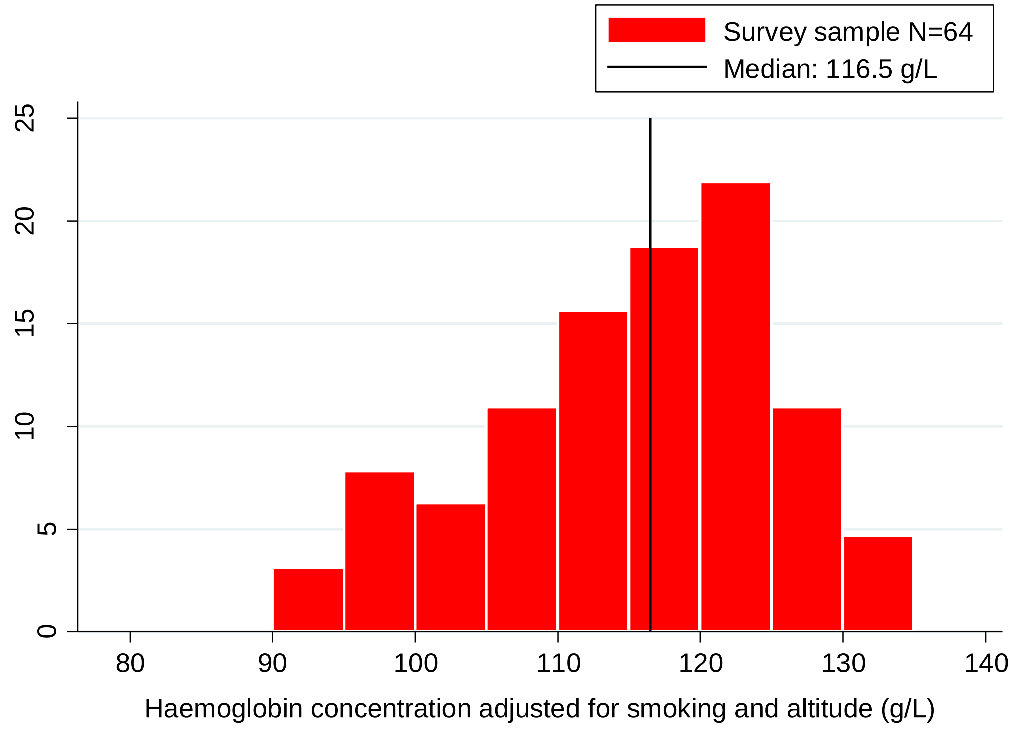

Figure 12. Distribution of haemoglobin (g/L) in pregnant women, Montenegro 2022

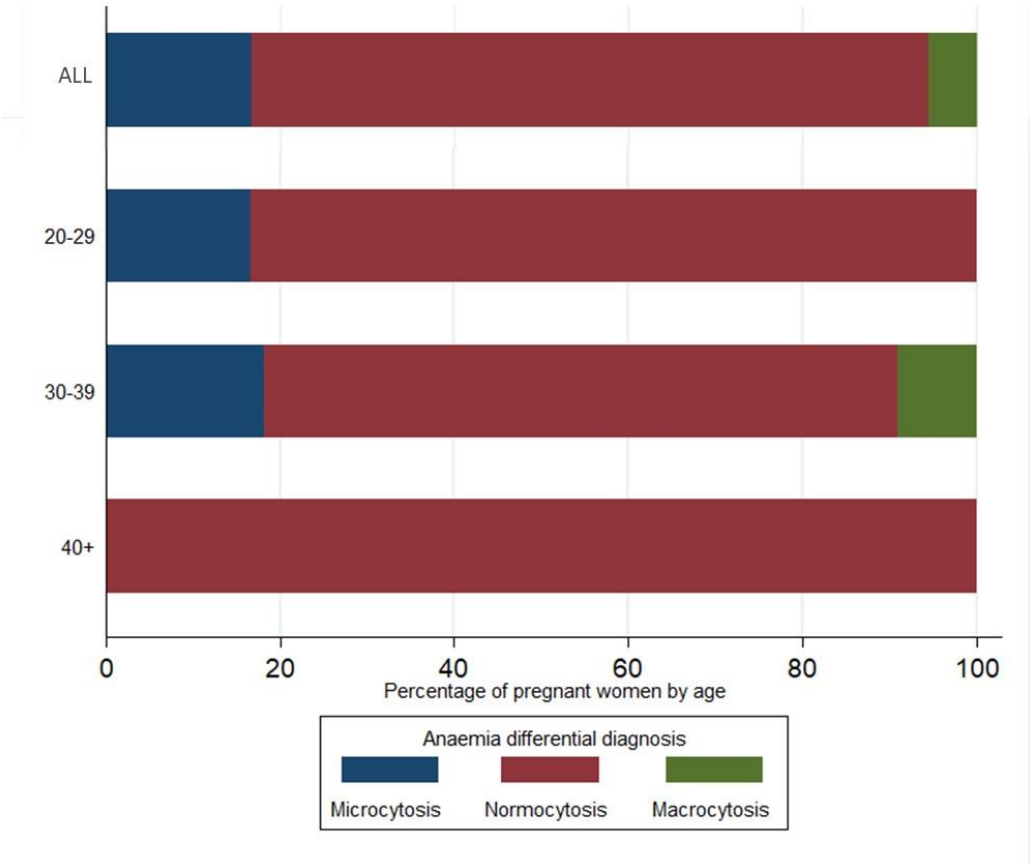

Figure 13. Anaemia type based on MCV among anaemic pregnant women, Montenegro 2022

3.6.5. Vitamin D deficiency

Among pregnant women, approximately 10 per cent and 40 per cent are classified as vitamin-D-deficient and vitamin-D-insufficient, respectively (Table 52). Combined vitamin D deficiency or insufficiency is significantly associated with residence, with a higher prevalence found in women from rural areas. The significantly higher prevalence of vitamin D deficiency or insufficiency in pregnant women from rural areas is driven almost entirely by a higher vitamin D insufficiency prevalence as the deficiency prevalence is nearly the same in urban and rural areas. Vitamin D deficiency and insufficiency are also significantly associated with wealth quintile, with the lowest prevalence found in the middle quintile whereas the remaining quintiles all had a prevalence of about 50–70 per cent. There is no significant association between vitamin D status and trimester, but it is notable that nearly 81 per cent of women in their first trimester have vitamin D deficiency or insufficiency, whereas the prevalence in the second and third trimesters is approximately 45 per cent.

Table 52. Prevalence of vitamin D deficiency or insufficiency in pregnant women, by various demographic characteristics, Montenegro 2022

		Deficient [a]		Insufficient [a]		Deficient or insufficient [a]		
Characteristic	**N**	**% [b]**	**[95% CI] [c]**	**% [b]**	**[95% CI] [c]**	**% [b]**	**[95% CI] [c]**	**p-value [d]**
Age group (in years)								0.840
20–29	23	3.3	[0.4, 20.3]	52.5	[33.2, 71.1]	55.8	[36.0, 73.8]	
30–39	39	10.9	[4.1, 26.1]	37.1	[23.6, 52.9]	48.0	[32.7, 63.7]	
40+	2	50.0	[5.6, 94.4]	0	-	50.0	[5.6, 94.4]	
Residence								0.013
Urban	32	9.4	[2.9, 26.4]	25.9	[13.4, 44.2]	35.3	[20.2, 54.1]	
Rural	32	9.5	[2.9, 27.0]	56.6	[41.9, 70.2]	66.1	[50.0, 79.1]	
Region								0.379
South	18	11.1	[2.8, 34.8]	33.3	[14.9, 58.8]	44.4	[20.1, 71.8]	
Centre	31	3.2	[0.4, 20.7]	41.9	[28.1, 57.2]	45.2	[30.9, 60.3]	
North	15	20.0	[6.5, 47.5]	46.7	[23.8, 71.1]	66.7	[40.2, 85.6]	
Wealth quintile								0.036
Lowest	12	8.6	[1.2, 43.0]	60.1	[31.8, 83.0]	68.7	[39.0, 88.2]	
Second	9	25.4	[5.9, 64.6]	39.7	[20.4, 62.9]	65.1	[40.5, 83.6]	
Middle	18	6.1	[0.8, 34.2]	14.8	[4.9, 36.9]	20.9	[8.0, 44.7]	
Fourth	12	0	-	61.3	[36.7, 81.3]	61.3	[36.7, 81.3]	
Highest	13	12.8	[3.4, 37.8]	40.0	[18.4, 66.4]	52.8	[25.7, 78.4]	
Educational attainment [e]								0.320
Lower attainment	4	0	-	75.0	[23.1, 96.8]	75.0	[23.1, 96.8]	
Higher attainment	60	10.2	[4.5, 21.5]	38.8	[27.8, 51.0]	49.0	[36.7, 61.4]	
Trimester of pregnancy								0.140
1	10	22.3	[5.6, 58.1]	58.6	[27.9, 83.8]	80.9	[46.1, 95.4]	
2	28	5.1	[1.3, 18.6]	40.5	[24.7, 58.6]	45.6	[29.0, 63.3]	
3	26	9.4	[2.4, 31.0]	35.5	[18.2, 57.6]	44.9	[25.6, 65.9]	
TOTAL	64	9.5	[4.2, 20.1]	41.4	[30.2, 53.6]	50.9	[38.8, 62.9]	

Note: The N numbers are the denominators for a specific sub-group. [a] Deficient <12 ng/mL; Insufficient 12–19.9 ng/mL.
[b] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.
[c] CI = confidence interval calculated taking into account the complex sampling design. [d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others. [e] Categories based on the distribution of the education data

3.6.6. Associations between micronutrient deficiencies and various factors

As shown in Table 53, anaemia in pregnant women is significantly associated with multivitamin consumption in the previous six months and minimum dietary diversity. The anaemia prevalence among women who took multivitamin supplements is more than 20 percentage points higher than among women who did not take multivitamins. Regarding dietary diversity, the anaemia prevalence is more than 50 percentage points lower among women with a minimally diverse diet.

Table 53. Association between anaemia and various factors in pregnant women, Montenegro 2022

Characteristic	N	% Anaemic [a]	p-value [b]
Minimum dietary diversity			0.002
No	8	77.5	
Yes	56	22.4	
Took iron tablets or syrup in previous six months			0.261
No	42	24.8	
Yes	22	39.5	
Took folate supplements in previous six months			0.888
No	28	30.7	
Yes	36	28.9	
Took vitamin A tablets in previous six months			0.259
No	60	28.1	
Yes	4	54.0	
Took multivitamin supplements in previous six months			0.028
No	38	19.4	
Yes	26	44.8	
Took vitamin D supplements in previous six months			0.975
No	55	28.6	
Yes	8	28.1	
Woman's vitamin D status			0.667
Normal	32	26.4	
Insufficient	26	36.1	
Deficient	6	19.2	

Note: The N numbers are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

The associations between vitamin D deficiency or insufficiency in pregnant women and dietary behaviours are shown in Table 54. Vitamin D deficiency or insufficiency is significantly associated with the consumption of multivitamins and vitamin D supplements in the past six months, with markedly lower prevalences found among women consuming the supplements.

Table 54. Correlation between various factors and vitamin D deficiency in pregnant women, Montenegro 2022

Characteristic	N	% [a] Vitamin-D-deficient or -insufficient	p-value [b]
Minimum dietary diversity			0.184
No	8	73.8	
Yes	56	47.3	
Took multivitamin supplement in previous six months			0.015
No	38	62.3	
Yes	26	34.3	
Took vitamin D supplement in previous six months			0.035
No	55	56.1	
Yes	8	19.9	

Note: The N numbers are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

3.6.7. Associations between components of metabolic syndrome and nutrition indicators

As shown in Table 55, there are few significant associations between the nutrition indicators and the various components of metabolic syndrome. Only elevated triglycerides and anaemia are significant associated, with the prevalence of elevated triglycerides substantially higher in anaemic women.

Table 55. Association between components of metabolic syndrome and various factors in pregnant women, Montenegro 2022

	Elevated HbA1c [a]			Elevated triglycerides [b]			Low HDL cholesterol [c]			Hypertension [d]		
	N	% [e]	p-value [f]	N	% [e]	p-value [f]	N	% [e]	p-value [f]	N	% [e]	p-value [f]
Minimum dietary diversity			0.575			0.244			0.111			0.308
No	8	0		8	63.8		8	22.5		8	0	
Yes	56	3.3		54	41.7		55	5.6		56	10.7	
Anaemia			0.364			0.036			0.422			0.082
No	46	1.7		44	35.5		45	6.1		46	13.3	
Yes	18	5.6		18	65.4		18	12.2		18	0	
Vitamin D deficiency or insufficiency			0.823			0.684			0.273			0.515
No	32	2.4		32	47.6		31	3.8		32	11.9	
Yes	32	3.3		30	41.8		32	11.8		32	6.8	
Tobacco smoking			0.451			0.199			0.301			0.161
No	51	3.6		51	40.8		51	6.1		51	11.8	
Yes	13	0		11	62.4		12	15.3		13	0	

Note: The N numbers are the denominators for a specific sub-group.

[a] Diabetes as HbA1c ≥5.7%.

[b] Elevated triglycerides ≥150 mg/dL in fasting women and ≥200 mg/dL in non-fasting women.

[c] Low HDL cholesterol <50 mg/dL.

[d] Hypertension as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg.

[e] Percentages weighted for unequal probability of selection among regions.

[f] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

3.6.8. Associations between sun exposure and vitamin D deficiency

Table 56 displays the association between vitamin D deficiency or insufficiency and various indicators of sun exposure. No significant association is found, and for some analysis, p-values could not be calculated due to the small sample size found in the sub-groups. Generally, the practice of protecting one's head, arms, or hands from the sun is rarely practised by the pregnant women participating in the MONS.

Table 56. Association between vitamin D deficiency or insufficiency and sun exposure in pregnant women, Montenegro 2022

Characteristic	N	%[a] Deficient	%[a] Insufficient	% [a] Deficient or insufficient	p-value [b]
Usually protects head from sun when outside					0.576
Never/rarely	48	6.3	46.3	52.6	
Sometimes	9	12.2	37.6	49.8	
Most of the time	1	0	100	100	
All the time	6	32.1	0	32.1	
How she protects head from sun when outside					-
Scarf/headcloth	3	74.7	25.3	100	
Hat	13	6.0	26.4	32.4	
Umbrella	0	0	0	0	
Usually covers arms when outside					0.370
Never/rarely	57	8.6	43.2	51.8	
Sometimes	5	0	36.3	36.3	
Most of the time	1	0	0	0	
All the time	1	100	0	100	
Usually covers hands when outside					-
Never/rarely	62	9.7	41.2	50.9	
Sometimes	2	0	50.0	50.0	
Most of the time	0	0	0	0	
All the time	0	0	0	0	
Approximate daily time spent in the sun					0.158
None	1	0	100	100	
1–29 minutes	7	0	37.6	37.6	
30–59 minutes	17	6.5	28.2	34.7	
1–2 hours	21	14.1	47.5	61.6	
2–3 hours	14	5.9	35.5	41.4	
>3 hours	4	26.1	73.9	100	
Usually uses sunscreen					0.148
Never/rarely	34	10.8	49.3	60.0	
Sometimes	17	13.6	30.7	44.3	
Most of the time	10	0	43.0	43.0	
All the time	3	0	0	0	
Respondent skin colour					0.449
Very white/white	29	16.9	36.6	53.5	
Olive	31	3.8	41.3	45.0	
Dark/very dark	4	0	75.0	75.0	
Sun exposure index					0.432
20+	29	10.2	51.0	61.1	
10–19.9	15	12.2	32.1	44.3	
0.01–9.9	16	7.7	36.2	44.0	
0	4	0	27.0	27.0	

Note: The N numbers are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] A p-value <0.05 indicates that the groups are statistically significantly different from each other.

4. DISCUSSION AND CONCLUSIONS

Anaemia and micronutrient deficiencies

The results of the MONS show that anaemia is more common in women than in preschool children. Nonetheless, the prevalence of iron deficiency is high in both groups, and iron deficiency is likely responsible for the majority of anaemia found. Nearly all anaemic children and women are iron-deficient, and iron deficiency is the only nutritional indicator that is significantly associated with anaemia in the bivariate analyses of both children and women. Moreover, the mean corpuscular volume (MCV) of red blood cells indicate that most anaemic children and women are microcytic, a condition that is caused by iron deficiency. Macrocytosis (i.e. an abnormally high MCV) is not found in any anaemic children but is found in a small proportion (5%) of adolescent girls 15–19 years of age. This finding corresponds to a significantly higher proportion of folate deficiency in this age group.

Iron deficiency is the most common micronutrient deficiency in Montenegro and affects about 40 per cent of children and almost 60 per cent of non-pregnant women. The prevalence of iron deficiency is particularly high in children 12–23 months of age (~70%) and also tends to be higher in children living in urban centres. For non-pregnant women, the MONS finds that taking multivitamin supplements is associated with a lower prevalence of iron deficiency. As multivitamins are prescribed less frequently than other vitamin or mineral supplements, the association between multivitamin consumption and iron deficiency may indicate that women are taking multivitamin supplements prophylactically and that the additional iron included in the supplements increases women's iron stores. As consumption of multivitamin supplements is also associated with a lower prevalence of anaemia, it is highly plausible that multivitamin consumption is also preventing cases of anaemia. In contrast, non-pregnant women who take iron supplements have a higher, albeit not significantly higher, prevalence of iron deficiency. As more that 80 per cent of women consuming iron supplements were prescribed these supplements by their doctors, it is likely that iron supplements are taken following a diagnosis of iron deficiency or anaemia.

The MONS finds that vitamin D deficiency is rare in children and affects nearly one tenth of women. Despite the relatively low deficiency levels, the combined prevalence of vitamin D deficiency and insufficiency are relatively high, particularly considering that skin covering practices are infrequently practised in both groups [55]. The prevalence of both vitamin D deficiency and insufficiency were likely affected by the season when the MONS was conducted (i.e. autumn) as vitamin D status is predominantly driven by sun exposure. Thus, one could anticipate that the prevalence of vitamin D deficiency and insufficiency in Montenegro would be lower during the spring/summer months and higher during the winter months, as exposure to sunlight increases and decreases, respectively, during these seasons. Similar seasonal findings have been observed in in other European countries [53].

Nearly 20 per cent of non-pregnant women are folate-deficient, with significantly higher levels found in younger women. Folate deficiency inhibits cell division, which can manifest as megaloblastic anaemia [54]. As macrocytosis was found in anaemic adolescent girls 15–19 years of age, it is likely that part of the anaemia in this age group is caused by folate deficiency. Folate deficiency can also cause neural tube defects during the early stages of gestation [54], thus, addressing folate deficiency in Montenegro potentially reduces anaemia and prevents birth defects. Despite the observed linkages between folate deficiency and megaloblastic anaemia, the threshold used for folate deficiency (i.e. <10 nmol/L) is the threshold at which homocysteine levels start to rise and thus women in the very yearly stages of folate deficiency are classified as deficient. Using the threshold for more severe folate deficiency at which megaloblastic changes tend to appear would have resulted in a lower deficiency prevalence. This was, however, not possible since the WHO only recommends a cut-off based on megaloblastic changes using a microbiological assay to measure folate concentration and not a protein-binding assay, which was used in this survey.

The MONS found that vitamin A deficiency is nearly non-existent in Montenegrin women and children. While there is scant population-representative data on vitamin A deficiency in Europe, this finding is not surprising, as vitamin A deficiency in developed countries is rare with the exception of individuals with a disease that causes lipid maldigestion or malabsorption [55] [58].

Infant and young child feeding

The MONS found that the proportion of children ever breastfed was 75 per cent, which was slightly lower than the prevalence (86%) reported by the 2018 MICS. In contrast, the prevalence of early initiation of breastfeeding found by the MONS was 45 per cent and is markedly higher than the 24 per cent prevalence reported by the 2018 MICS [6]. While some of the ~20 percentage point difference between the early initiation of breastfeeding estimates may be explained by the different samples selected by both surveys, there has been several interventions implemented in the one to two years before the MONS that could have helped to increase the prevalence of early initiation of breastfeeding. To illustrate, in early 2021, the Ministry of Health established a National Breastfeeding Committee and re-introduced the Baby-Friendly Hospital Initiative (BFHI), a programme designed to improve the breastfeeding practices and the care of mothers and newborns at health facilities. This was followed in 2021 and 2022 by the training of hospital and healthcare workers on the BFHI IYCF practices, and International Code on the Marketing of Breastmilk Substitutes. Simultaneously, the IPH and UNICEF launched the mobile parenting app “Bebbo” that contains information about breastfeeding practices. By December 2022, the app had had nearly 10,000 downloads, and had more than 6000 registered users. By April 2023, all health facilities had introduced “rooming-in”, a practice where mothers and newborns remain together in the same rooming 24 hours a day following childbirth. While these initiatives were only implemented for a short period of time before the MONS, the results from both the MICS and MONS indicate that some breastfeeding practices are suboptimal and should be improved.

With respect to complementary feeding indicators in children 6–23 months of age, the MONS found similar results to the 2018 MICS [6]. The prevalence of minimal meal frequency was the same for both surveys (84%) and minimum dietary diversity was slightly higher in the MONS (74%) than the MICS (64%). Due to the higher dietary diversity prevalence found by the MONS, the prevalence of minimum acceptable diet reported by the MONS (55%) was also higher than in the MICS (49%). Although minimum acceptable diet is a composite of minimum dietary diversity and minimum meal frequency prevalence, the prevalence of minimum acceptable diet is relatively low. This is because about one quarter of children that have minimum meal frequency *do not* have minimum dietary diversity. Essentially, there is a sizable cohort of children that are fed with sufficient frequency for their age but are only fed a limited variety of foods. This practice has been seen elsewhere [56]. Based on this finding, programmes in Montenegro that aim to improve the minimum acceptable diet of children 6–23 months of age should emphasize the importance of dietary diversity.

Cardiometabolic health and metabolic syndrome

In addition to micronutrient deficiencies, the MONS identified multiple concerns related to the cardiometabolic health of women. The most concerning finding is that more than 10 per cent of women have metabolic syndrome. Individuals with metabolic syndrome have higher rates of diabetes, heart disease and certain cancers [57]. According to Montenegro's 2022 population estimates [58], there were an estimated 201,881 women 15–64 years of age as of December 2022. Assuming the population is equally distributed, there were 141,317 women 15–49 years old and 60,564 women 50–64 years old as of December 2022. Using the estimate of the 15–49 year-old population and the MONS's estimate for the prevalence of metabolic syndrome (i.e. 11.4%), there are an estimated 16,110 women 15–49 years of age with metabolic syndrome in Montenegro. However, using the population estimate for women 50–64 years of age and the metabolic syndrome prevalence found in women 40–49 years of age (i.e. 18.8%), there are an estimated 11,386 women 50–64 years of age with metabolic syndrome.

This is a serious concern as the adverse health effects of metabolic syndrome are responsible for a sizable proportion of Montenegro's disease burden. An analysis from 2002–2003 in Serbia and Montenegro found that the conditions related to metabolic syndrome (i.e. stroke, ischaemic heart disease and diabetes) were responsible for more than 50 per cent of the disease burden in adult women. The proportion of the disease burden attributable to these three conditions and various cancers accounted for nearly two thirds (70%) of the disease burden [59]. As this study is outdated, more current research on this topic is warranted for Montenegro.

Thus, reducing the prevalence of metabolic syndrome could have a strong effect on the disease burden and potentially on health expenditures and poverty. An economic analysis of health expenditures and poverty in Balkan states found that, in Montenegro, increased health expenditures raise the poverty headcount by 6 per cent and the poverty gap by 1 per cent [60]. In comparison to neighbouring countries, health expenditures in Montenegro only have a minimal effect on household-level poverty. Nonetheless, the cost of healthcare is a concern in Montenegro; in 2017, 10 per cent of households reported "catastrophic health spending" or spending of 10 per cent or more of household income on health care [61]. It is also plausible that poverty could exacerbate metabolic syndrome by restricting the purchase of nutrient dense foods in favour of cheaper foods high in sugar, salt, and low-quality fats.

While the five components of metabolic syndrome are all highly associated with each other, some conditions, such as diabetes, are relatively rare and marginally contribute to the metabolic syndrome observed. Albeit small, the prevalence of diabetes and pre-diabetes estimated by the MONS is likely an overestimation, as iron deficiency and iron deficiency anaemia can artificially increase the levels of HbA1c by altering erythrocyte turnover [62]. In contrast to diabetes, the most common components of metabolic syndrome identified by the MONS are visceral/central obesity and low HDL cholesterol. Visceral/central obesity reflects a condition where an individual has excess adipose tissue, which is associated with increased circulating triglyceride levels and chronic inflammation [63]. The MONS identified that more than 40 per cent of women have visceral/central obesity, and that the prevalence increases by age. More than 60 per cent of women 40–49 years of age have visceral/central obesity. This estimate is notably higher than the 2016 estimated obesity prevalence of 23 per cent reported by WHO [64] for Montenegrin adults over 18 years of age. HDL cholesterol, often referred to as “good” cholesterol, removes other forms of cholesterol from the blood and subsequently helps to prevent heart disease. The MONS found low HDL in approximately 30 per cent of women. Despite a slightly higher prevalence (~40%) found in smokers and those living in the northern region and the lowest wealth quintile households, the MONS data suggests that low HDL is a population-wide problem.

Researchers have found that “clustering” of the metabolic syndrome components in other European countries is not homogenous [65] and an understanding of the concurrent conditions is important for designing appropriate interventions. In Montenegro, the most common “cluster” of conditions is low HDL cholesterol, visceral/central obesity and elevated triglycerides; these concurrent conditions account for approximately half of the incidences of metabolic syndrome observed in Montenegrin women. This “clustering” is accompanied by a relatively high prevalence of a high triglyceride/HDL ratio, which is a strong predictor of cardiovascular diseases [66] and gestational diabetes [67]. This “clustering” indicates that metabolic syndrome in Montenegro is largely driven by obesity, which itself is generally caused by excessive caloric intake, sedentarism and other adverse health behaviours, such as smoking [68].

All the metabolic syndrome conditions are significantly associated with inflammation. This association has been widely observed [69], however, the direction of causation — and the mechanism underlying the association — is uncertain. For example, some research suggests that central/visceral obesity causes localized inflammation that, in turn, leads to systemic chronic inflammation [63]. In contrast, other research suggests that inflammation — potentially caused by aging, physical inactivity, or overnutrition — could result in the chronic overproduction of cytokines that induce pre-diabetes and diabetes [69].

Smoking is also a serious public health problem in Montenegro. While smoking is more common among men [70], the MONS shows that smoking is practised by a large proportion of women, including pregnant and breastfeeding women. In addition to causing cancer, smoking is a main contributor to cardiovascular diseases [71], particularly by limiting the production of HDL cholesterol [72].

Cardiometabolic health and nutrition

The MONS found that women with vitamin D deficiency/insufficiency have significantly higher prevalences of elevated triglycerides, low HDL cholesterol or central/visceral obesity. These associations have been previously observed by researchers examining the linkages between vitamin D deficiency and metabolic health. A recent systematic review and meta-analysis found that vitamin D supplementation helps lower total cholesterol, LDL cholesterol and triglyceride levels but not HDL cholesterol levels, with larger effects on total cholesterol and triglycerides found in subjects that were deficient in vitamin D at baseline [73]. Regarding vitamin D and obesity, while the association between these two factors has been identified previously, the directionality of the association remains unclear. Obesity can result in lower circulating vitamin D concentrations because of "volumetric dilution into the greater volumes of fat, serum, liver and muscle" [74]. At the same time, vitamin D deficiency limits the proliferation and creation of fat cells (adipogenesis) [75] and thus could help to reduce the risk of obesity.

5. STRENGTHS AND LIMITATIONS

A key strength of the MONS is the measurement of all biomarkers using venous blood samples with recommended methods. The use of venous blood samples removes potential pre-analytical biases (e.g. dilution from interstitial fluid, small sample volume) that can occur with capillary blood sampling. There is a growing body of research that indicates that using capillary samples frequently results in lower haemoglobin concentrations and subsequently cause artificially high anaemia prevalences. Also, the MONS measured haemoglobin via complete blood count rather than a portable device. The use of a CBC increases the certainty of the haemoglobin results and also yielded the indicator, MCV, which was used to identify the type of anaemia occurring in children and women. Another strength of the MONS is the measurement of all biomarkers by laboratories that participate in external quality assurance programmes for the biomarkers measured.

A key limitation of the MONS is that it did not include a stratum for Roma communities in Montenegro, and thus could not produce representative results for Roma children and women. Another limitation was the low response rate for children 6–59 months of age. As the MONS was not able to collect information from individuals in households that refused to participate, it is not possible to determine if this low response rate biased the sample in any way. In addition, because the MONS is a cross-sectional survey, the association between any two variables cannot be considered causal. Moreover, the time period of data collection —

October to December, Montenegro's autumn— could have influenced the prevalence and distribution of certain variables, such as vitamin D deficiency and insufficiency.

6. RECOMMENDATIONS

Address anaemia and iron deficiency via fortification:

The prevalence of iron deficiency was high in both children and women, and iron deficiency is likely the main risk factor of anaemia in Montenegro. Increasing iron intake can be accomplished with multiple approaches. Multiple micronutrient fortification of staple foods (e.g. wheat flour) including iron and folic acid is a population-level intervention that has been shown to reduce the prevalence of iron deficiency and folate deficiency [76] and is thus a viable approach to reduce the prevalence of anaemia and reduce neural tube birth defects [77]. Based on the 2020 food balance sheets of the Food and Agriculture Organization (FAO), the annual per capita consumption of wheat flour products in Montenegro is about 123 kilograms, which equates to approximately 337 grams per capita per day [78] — a relatively high consumption level. To ensure that a flour fortification programme can be implemented, it will be necessary to carry out a feasibility assessment prior to identifying the relevant stakeholders, to establish the procedures for setting fortification standards, to estimate the programme costs, and to establish monitoring and compliance procedures.

Vitamin D supplementation during breastfeeding

As the MONS found that approximately 16 per cent of breastfeeding women are deficient in vitamin D, a targeted supplementation programme should be considered. While the targeting of vitamin D supplements to postpartum women is often conducted to increase the vitamin D levels of breastmilk [79] and thus the vitamin D status of their offspring, its use for this purpose is not required in Montenegro, as the prevalence of vitamin D deficiency and insufficiency in children younger than 12 months is relatively low. Rather, vitamin D supplements targeted to breastfeeding women can be used to prevent osteoporosis, hypocalcaemia, and hypertension [80]. Thus, it is recommended that breastfeeding mothers are either screened for vitamin D deficiency during postnatal visits or prescribed prophylactic vitamin D supplements.

Improve vitamin D status via fortification

The prevalence of vitamin D deficiency and insufficiency are relatively high in children older than 12 months of age and in women. As such, the fortification of staple foods with vitamin D can be considered in order to increase vitamin D intake and to prevent the sequelae of vitamin D deficiency. Products such as milk, yogurt, margarine and vegetables are fortified in some European countries, and vitamin D fortification in the European Union prevented an estimated 11,000 deaths from cancer in 2017 [81]. It is therefore recommended that a feasibility assessment for vitamin D fortification be conducted. Such an assessment can consider multiple food vehicles, but current consumption estimates suggest that milk may be a viable food vehicle. According to the FAO's 2020 food balance sheets, Montenegro has the highest per capita milk consumption of any country — 338 kg/capita/year (~0.93 litres/capita/day) [78].

Improve infant and young child feeding practices

The MONS found that some breastfeeding and complementary feeding practices are suboptimal. Regarding breastfeeding, the MONS found that early initiation of breastfeeding was practised by 45 per cent of children and exclusive breastfeeding in the two days after birth by 55 per cent of children. Early initiation of breastfeeding reduces the risk of infections [82] and feeding newborns liquids other than breastmilk after birth can adversely affect the practice of breastfeeding. The WHO's maternity care guidelines state that "mothers should be discouraged from giving any food or fluids other than breastmilk, unless medically indicated" [83]. While the MONS cannot determine the reason underlying these suboptimal breastfeeding behaviours, it is plausible that insufficient information and/or support are provided to women during the antenatal and postnatal period. As such, the continued expansion of Montenegro's BFHI and breastfeeding counselling can be recommended. In addition, to clearly identify the barriers to optimal breastfeeding practices after birth, research about the breastfeeding support provided at hospitals/clinics and the breastfeeding-related knowledge, attitudes and practices of women who have recently given birth should be conducted.

In addition to breastfeeding, the minimum acceptable diet in children 6–23 months of age should be improved. Only 58 per cent of children have a minimum acceptable diet and the prevalence is lowest amongst children from households with low wealth scores. As the MONS found that the meal frequency of children 6–23 months of age was relatively high for all wealth quintiles, a lack of dietary diversity in low-wealth households is responsible for low minimum acceptable diet prevalence. As such, supplemental nutrition programmes or income support programmes targeted at children in low-wealth/low-income households could be considered in order to improve the dietary diversity of children. These programmes can also be implemented alongside awareness campaigns that stress the importance of a diverse diet and frequent feeding of children 6–23 months of age.

Address risk factors of metabolic syndrome

As the MONS finds that obesity is a key risk factor for metabolic syndrome, identifying adults with obesity is the first step to addressing metabolic syndrome. Diagnosis and treatment of obesity, rather than other components of metabolic syndrome, is recommended, as obesity can be ascertained using non-invasive approaches and at a relatively low cost. Thus, it is imperative that doctors and healthcare providers have the knowledge and equipment to diagnose obesity in adults. In particular, the measurement of waist circumference — the obesity measurement used by the MONS — should be used for obesity screening, as the measurement of body mass index is a less sensitive indicator of cardiometabolic risk factors

[84]. Following a diagnosis of visceral/central obesity, other components of metabolic syndrome can be assessed.

Following a diagnosis of visceral/central obesity or other components of metabolic syndrome, doctors or healthcare professionals should identify the dietary and lifestyle behaviours of the individual in order to recommend relevant individual-level interventions. These may include modification to the diet, exercise, cessation of smoking, and bariatric surgery for cases of morbid obesity [68].

At the population level, public health intervention to modify the food environment can be pursued. Demand-creation activities such as educational campaigns and behaviour change communication programmes have been shown, albeit inconsistently, to increase the consumption of vegetables in adults [85]. Importantly, the most effective behaviour change interventions engaged stakeholders during the design phase [85], and thus any future behaviour change programme in Montenegro should be carefully designed in order to increase its effectiveness and sustainability. In addition, programmes to increase the supply of healthy foods can also be pursued. Community-level programmes have been shown to increase the consumption of fruits and vegetables by increasing the availability and lowering the price of healthy foods [86]. Although the MONS did not assess physical activity, the WHO has identified the promotion of physical activity as an approach to prevent and reduce overweight and obesity [87]. This can include community-level programmes that encourage physical activity by modifying the “built environment” (e.g. sidewalks, bicycle lanes, exercise sites) and by promoting the benefits of active lifestyles.

In addition, population-level programmes that encourage adults to quit smoking or prevent the commencement of smoking should be pursued. Smoking prevention and cessation programmes can be seen as an approach to both reduce the prevalence of metabolic syndrome components and smoking-related cancers and diseases. Importantly, the MONS found that the prevalence of smoking was lowest among adolescent girls 15–19 years of age. While it is unclear if this relatively low prevalence reflects a long-term change in smoking patterns, efforts to prevent smoking uptake and encourage smoking cessation are warranted. Montenegrin researchers have shown that, like other industrialized countries, the population of Montenegro is sensitive to price increases and that governmental taxation of cigarettes is an effective approach to reduce the use of cigarettes [70]. Despite government taxes on cigarettes, the price of cigarettes in Montenegro is substantially lower than in countries in the European Union. The relatively low price of cigarettes is likely exacerbated by the illegal trade of tobacco products in Montenegro. As such, government policies to tax cigarettes and limiting the illegal sale of cigarettes by increasing inspections and controls on the illegal trade of tobacco can both be considered approaches to reduce the prevalence of smoking and subsequently metabolic syndrome.

Study focusing on health and nutrition status of Roma communities in Montenegro

As noted in Section 5, the MONS was not designed to produce representative results for children and women residing in Montenegro's Roma communities. Importantly, Montenegro's 2018 MICS found that the prevalence of stunting in Roma children (20.8%) was nearly three times as high as in non-Roma children (7.2%) [6]. As stunting is an indicator of chronic malnutrition, this may suggest that micronutrient deficiencies and other health problems are more common among Roma children and women. Thus, a comprehensive study that assesses the nutrition and health status of children and women in Montenegro's Roma communities should be considered. By ascertaining the prevalence and severity of a variety of conditions (e.g. anaemia, iron deficiency, folate deficiency, metabolic syndrome) in these communities, stakeholders in Montenegro can determine if a different suite of interventions tailored to the Roma community is warranted.

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8. APPENDICES

8.1. ADDITIONAL CHILD TABLES

Table 57. Proportion of mild, moderate and severe anaemia in children 6–59 months of age, by various demographic characteristics, Montenegro 2022

		Severe anaemia			Moderate anaemia			Mild anaemia		
Characteristic	**N**	**% [a, b]**	**[95% CI] [c]**	**p-value [d]**	**% [a, b]**	**[95% CI] [c]**	**p-value [d]**	**% [a, b]**	**[95% CI] [c]**	**p-value [d]**
Age group (in months)				0.620			0.003			0.006
6–11	26	0	-		0	-		18.4	[8.0, 36.8]	
12–23	68	0	-		12.3	[6.3, 22.7]		17.5	[10.8, 27.1]	
24–35	98	1.0	[0.1, 7.1]		4.1	[1.2, 12.7]		8.4	[3.8, 17.4]	
36–47	66	0	-		0	-		8.9	[4.1, 18.2]	
48–59	91	0	-		1.1	[0.1, 7.6]		1.2	[0.2, 8.4]	
Sex				0.289			0.853			0.163
Male	182	0	-		4.0	[1.9, 7.9]		7.3	[4.4, 11.8]	
Female	167	0.6	[0.1, 4.1]		3.6	[1.5, 8.4]		11.1	[7.2, 16.7]	
Residence				0.380			0.145			0.675
Urban	199	0.5	[0.1, 3.5]		5.2	[2.8, 9.5]		8.6	[5.4, 13.4]	
Rural	150	0	-		1.9	[0.5, 6.7]		9.8	[6.0, 15.7]	
Region				0.669			0.272			0.688
South	89	0	-		1.1	[0.1, 8.3]		11.2	[6.7, 18.2]	
Centre	174	0.6	[0.1, 4.0]		5.2	[2.8, 9.5]		8.0	[4.8, 13.3]	
North	86	0	-		3.5	[1.1, 10.4]		9.3	[4.4, 18.7]	
Wealth quintile				0.616			0.420			0.725
Lowest	88	0	-		4.3	[1.8, 10.3]		6.8	[2.9, 15.0]	
Second	71	1.4	[0.2, 9.1]		6.9	[3.1, 14.8]		9.5	[5.3, 16.5]	
Middle	63	0	-		3.4	[0.9, 11.7]		8.2	[3.6, 17.5]	
Fourth	66	0	-		1.8	[0.3, 11.7]		9.2	[4.1, 19.5]	
Highest	61	0	-		1.5	[0.2, 10.7]		13.3	[6.2, 26.2]	
TOTAL	349	0.3	[0.0, 2.0]		3.8	[2.2, 6.5]		9.1	[6.5, 12.7]	

Note: The N numbers are the denominators for a specific sub-group.

[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.

[b] Severe anaemia: <70 g/L, moderate anaemia: 70–99 g/L, mild anaemia: 100–109 g/L; all adjusted for altitude.

[c] CI = confidence interval calculated taking into account the complex sampling design.

[d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.

8.2. ADDITIONAL WOMEN'S TABLES

Table 58. Proportion of mild, moderate, and severe anaemia in non-pregnant women 15–49 years of age, by various demographic characteristics, Montenegro 2022

		Severe anaemia			Moderate anaemia			Mild anaemia		
Characteristic	**N**	**% [a, b]**	**[95% CI] [c]**	**p-value [d]**	**% [a, b]**	**[95% CI] [c]**	**p-value [d]**	**% [a, b]**	**[95% CI] [c]**	**p-value [d]**
Age group (in years)				0.905			0.007			0.363
15–19	153	0.7	[0.1, 4.7]		5.9	[3.2, 10.6]		11.1	[7.1, 17.0]	
20–29	321	0.3	[0.0, 2.3]		5.3	[2.9, 9.2]		16.9	[12.6, 22.3]	
30–39	568	0.7	[0.2, 2.3]		11.1	[8.9, 13.8]		15.0	[12.2, 18.4]	
40–49	584	0.8	[0.3, 2.0]		11.6	[9.1, 14.6]		16.6	[13.7, 20.1]	
Residence				0.157			0.646			0.776
Urban	969	0.4	[0.2, 1.1]		9.3	[7.7, 11.1]		15.8	[13.5, 18.5]	
Rural	657	1.0	[0.4, 2.2]		10.0	[7.6, 13.2]		15.2	[12.2, 18.9]	
Region				0.617			0.792			0.062
South	517	0.4	[0.1, 1.5]		8.9	[6.8, 11.6]		13.3	[10.8, 16.4]	
Centre	736	0.8	[0.4, 1.8]		10.1	[8.0, 12.5]		18.1	[15.2, 21.4]	
North	373	0.5	[0.1, 2.1]		9.4	[6.6, 13.2]		13.1	[9.4, 18.1]	
Wealth quintile				0.583			0.700			0.434
Lowest	324	0.9	[0.3, 2.8]		11.4	[8.4, 15.4]		12.9	[9.7, 17.0]	
Second	320	0.7	[0.2, 2.5]		9.4	[6.2, 14.0]		15.3	[11.1, 20.8]	
Middle	346	0.6	[0.2, 2.2]		9.9	[7.2, 13.6]		16.5	[13.0, 20.7]	
Fourth	315	0.9	[0.3, 2.7]		8.3	[5.4, 12.4]		15.4	[11.6, 20.1]	
Highest	321	0	-		8.6	[6.0, 12.1]		18.4	[14.6, 22.9]	
TOTAL	1626	0.6	[0.3, 1.2]		9.6	[8.2, 11.2]		15.6	[13.7, 17.7]	

Note: The N numbers are the denominators for a specific sub-group.

[a] All percentages, except region-specific estimates, are weighted for unequal probability of selection among regions.

[b] b Severe anaemia: <80 g/L, moderate anaemia: 80–109 g/L, mild anaemia: 109–119 g/L; all adjusted for altitude and smoking.

[c] CI = confidence interval calculated taking into account the complex sampling design.

[d] A p-value <0.05 indicates that at least one sub-group is statistically significantly different from the others.

8.3. COMPARISON OF SERUM RETINOL AND PLASMA RETINOL-BINDING PROTEIN

The biomarker used by the MONS to measure vitamin A status is plasma retinol-binding protein (RBP). Because RBP is not a WHO-recommended biomarker for the assessment of vitamin A status [30], serum specimens from preschool children 6–59 months of age (PSC) and non-pregnant women (NPW) were analysed for serum retinol to compare and validate the RBP measurements. Analysis of RBP was conducted at VitMin Lab (Freiburg, Germany), and the analysis of serum retinol was undertaken by SynLab (Munich, Germany). Both service laboratories have a demonstrable external quality assurance track record of analysing plasma retinol.

Figure 14 below presents the correlation plot and regression equation comparing retinol and RBP for both PSC and NPW combined (n=267; 123 PSC, 144 NPW). We found a good correlation between the RBP and plasma retinol values (R2=0.86). The estimated slope was 0.8019, showing that the RBP values were consistently lower than their serum retinol counterparts.

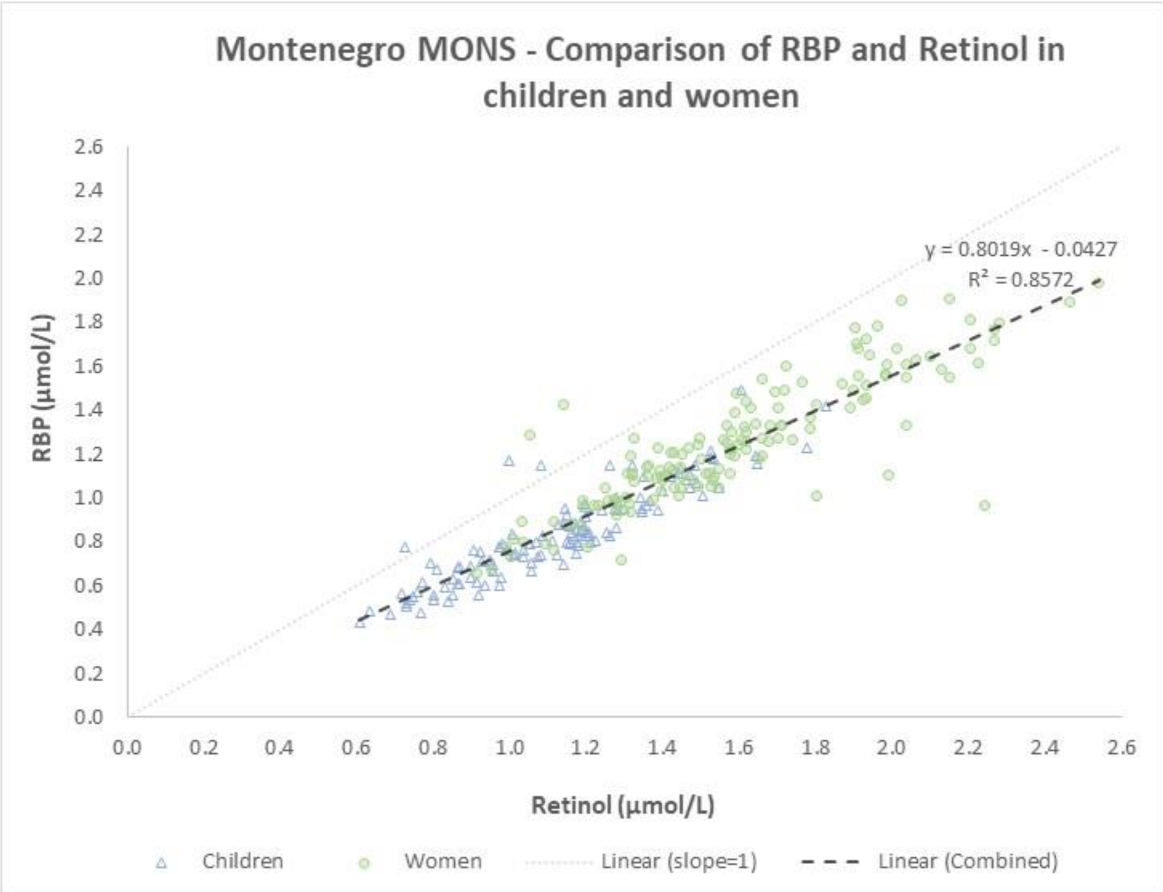

Figure 14. Combined comparison of retinol and retinol-binding protein concentrations in preschool children (PSC) and non-pregnant women (NPW), Montenegro 2022

Based on these results, the vitamin A deficiency cut-off was adjusted for RBP. Using the WHO-recommended cut-off for retinol of 0.7 µmol/L [30] and the regression equation in Figure 14 above, the RBP cut-off was calculated to be **0.51863 µmol/L** [(0.8019 × 0.7) − 0.0427 =

0.51863]. This cut-off value was subsequently used to classify both children and women with vitamin A deficiency.

A similar cut-off for vitamin A deficiency (i.e. 0.52375 µmol/L) was obtained when a regression equation was calculated for RBP and retinol measurements <1.2 µmol/L. This restricted analysis can be employed to ensure that the calculated cut-off for RBP reflects the result directly below and above the 0.7 µmol/L retinol cut-off.

Lastly, a Bland–Altman plot (Figure 15) was made to identify any potential outliers that could have been due to labelling errors. Due to the systematically higher retinol concentrations, the difference was calculated as the retinol concentration minus the RBP concentration. Based on this analysis, we removed: a) any values with a difference of >0.6, and b) any negative difference values. Subsequently, 10 retinol/RBP pairs were excluded from the analysis. A correlation plot developed with the 10 outliers removed had a good correlation (R2=0.93) and a regression equation of $0.8608x - 0.1236$, resulting in a cut-off of 0.47896 µmol/L.

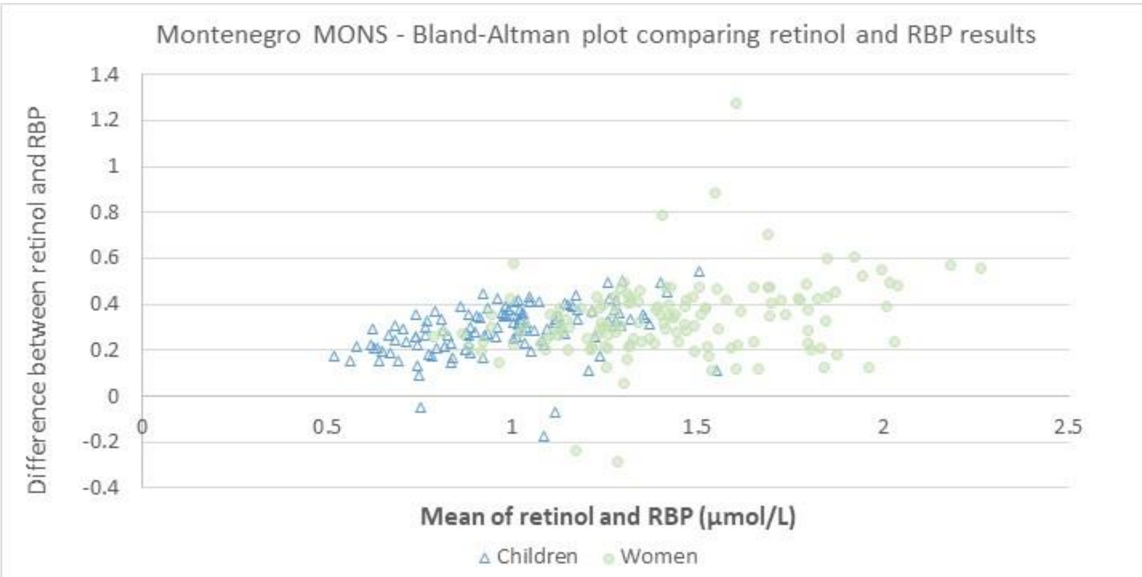

Figure 15. Combined comparison of retinol and retinol-binding protein concentrations in preschool children (PSC) and non-pregnant women (NPW), Montenegro 2022

8.4. A PRIORI SAMPLE SIZE CALCULATIONS

Table 59. Assumptions and results of sample size calculation for the southern, central and northern strata, by target group and micronutrient indicator

Target group and indicator	Estimated prevalence	Assumed design effect	Desired precision	Assumed Response rate	Number of persons	Precision
National						
Children 6–59 months						
Anaemia	33%	1.5	5%	51%	979	3.6%
Iron deficiency	50%	1.5	5%	51%	979	3.8%
Vitamin A deficiency	25%	1.5	5%	51%	979	3.3%
Vitamin D deficiency	25%	1.5	5%	51%	979	3.3%
Non-pregnant women						
Anaemia	25%	1.5	5%	45%	1404	3.1%
Iron deficiency	30%	1.5	5%	45%	1404	3.2%
Folate deficiency	30%	1.5	5%	45%	1404	3.2%
Pregnant women						
Anaemia	28%	1.5	5%	45%	146	9.3%
Southern stratum						
Children 6–59 months						
Anaemia	33%	1.5	6.5%	48%	299	6.5%
Iron deficiency	50%	1.5	10%	48%	299	6.9%
Vitamin A deficiency	25%	1.5	5%	48%	299	6.0%
Vitamin D deficiency	25%	1.5	5%	48%	299	4.9%
Non-pregnant women						
Anaemia	25%	1.5	6.5%	41%	509	5.1%
Iron deficiency	30%	1.5	10%	41%	509	5.3%
Folate deficiency	30%	1.5	10%	41%	509	5.3%
Central stratum						
Children 6–59 months						
Anaemia	33%	1.5	6.5%	36%	322	6.3%
Iron deficiency	50%	1.5	10%	36%	322	6.7%
Vitamin A deficiency	25%	1.5	5%	36%	322	5.8%
Vitamin D deficiency	25%	1.5	5%	36%	322	5.8%
Non-pregnant women						
Anaemia	25%	1.5	6.5%	29%	461	5.3%
Iron deficiency	30%	1.5	10%	29%	461	5.6%
Folate deficiency	30%	1.5	5%	29%	461	5.6%
Northern stratum						
Children 6–59 months						
Anaemia	33%	1.5	6.5%	70%	349	6.0%
Iron deficiency	50%	1.5	10%	70%	349	6.4%
Vitamin A deficiency	25%	1.5	5%	70%	349	5.6%
Vitamin D deficiency	25%	1.5	5%	70%	349	5.6%
Non-pregnant women						
Anaemia	25%	1.5	6.5%	67%	434	5.5%
Iron deficiency	30%	1.5	10%	67%	434	5.8%
Folate deficiency	30%	1.5	5%	67%	434	5.8%

Table 60. Assumptions and results of sample size calculation for the southern, central and northern strata, by target group and NCD risk factor

Target group and indicator	Estimated prevalence	Assumed design effect	Desired precision	Assumed Response rate	Number of persons	Precision
National						
Non-pregnant women						
Diabetes	10%	1.5	3%	45%	1404	1.9%
Elevated triglycerides	10%	1.5	3%	45%	1404	1.9%
Low HDL	35%	1.5	6.5%	45%	1404	3.1%
Visceral obesity	20%	1.5	5%	45%	1404	2.6%
Pregnant women						
Diabetes	10%	1.5	3%	45%	146	5,8%
Elevated triglycerides	10%	1.5	3%	45%	146	5,8%
Low HDL	35%	1.5	6.5%	45%	146	9,3%
Southern stratum						
Non-pregnant women						
Diabetes	10%	1.5	3%	41%	509	3.2%
Elevated triglycerides	10%	1.5	3%	41%	509	3.2%
Low HDL	35%	1.5	6.5%	41%	509	5.1%
Visceral obesity	20%	1.5	5%	41%	509	4.3%
Central stratum						
Non-pregnant women						
Diabetes	10%	1.5	3%	29%	461	3.4%
Elevated triglycerides	10%	1.5	3%	29%	461	3.4%
Low HDL	35%	1.5	6.5%	29%	461	5.3%
Visceral obesity	20%	1.5	5%	29%	461	4.5%
Northern stratum						
Non-pregnant women						
Diabetes	10%	1.5	3%	67%	434	3.5%
Elevated triglycerides	10%	1.5	3%	67%	434	3.5%
Low HDL	35%	1.5	6.5%	67%	434	5.5%
Visceral obesity	20%	1.5	5%	67%	434	4.6%

8.5. ETHICAL APPROVAL

Broj: 01-6436
Podgorica: 21.07.2022

[illegible]

Na osnovu člana 40 Statuta Instituta za javno zdravlje Crne Gore, Etički komitet Instituta za javno zdravlje Crne Gore je donio

ODLUKU
o davanju saglasnosti na istraživanje

I Etički komitet Instituta za javno zdravlje Crne Gore daje saglasnost na istraživanje o učestalosti mikronutritivnih deficita u Crnoj Gori u 2022. godini (MONS 2022).

II Ova Odluka stupa na snagu danom donošenja iste.

OBRAZLOŽENJE

Na II sjednici Etičkog komiteta Instituta za javno zdravlje Crne Gore, koja je održana dana 12.07.2022. godine, a na predlog predsjednika Etičkog komiteta Instituta, jednoglasno je data saglasnost na **„Istraživanje o učestalosti mikronutritivnih deficita u Crnoj Gori u 2022. godini (MONS 2022)"**, a sve u skladu sa Poslovnikom o radu Etičkog komiteta i članom 40 Statuta Instituta za javno zdravlje Crne Gore.
Na osnovu prethodne sveobuhvatne analize dostavljenih materijala od strane članova Etičkog komiteta i uz prisustvo koordinatora istraživanja koji je bio pozvan da na sjednici dodatno obrazloži plan, organizaciju i metodologiju istraživanja, konstatovano je da navedeno istraživanje, koje planira da sprovede Institut za javno zdravlje Crne Gore u saradnji sa UNICEF-om, je u skladu sa načelima medicinske etičke i deotologije, te da ne postoje etičke prepreke za davanje saglasnosti na istraživanje.

Na osnovu obrazloženja datog na II sjednici, članovi Članovi Etičkog komiteta Instituta za javno zdravlje Crne Gore su odlučili kao u dispozitivu ove Odluke.

PRAVNA POUKA: Protiv ove Odluke može se izjaviti prigovor direktoru Instituta u roku od 15 dana od dana stupanja na snagu ove odluke.

INSTITUT ZA JAVNO ZDRAVLJE CRNE GORE
PREDSJEDNIK
ETIČKOG KOMITETA

dr Borko Bajić

DOSTAVITI:
- Direktoru IJZCG;
- Arhiva;
- Koordinatoru istraživanja;

100 godina
U SLUŽBI ZDRAVLJA I UNAPREĐENJA ZDRAVLJA STANOVNIŠTVA CRNE GORE

8.6. INFORMATION SHEET AND CONSENT FORM

INFORMATION SHEET (FOR THE PARTICIPANT TO KEEP)	
Title of Study:	**Montenegro Nutrition Survey (MONS)**
Principal Investigator: Survey coordinators:	Dijana Đurović (Institute of Public Health of Montenegro) Ida Ferdinandi & Senad Begic (UNICEF Montenegro)
Certified Protocol Number	01-6436

General information

The Montenegro Nutrition Survey (MONS) is being conducted to understand the severity of various nutritional deficiencies, such as anaemia, iron and folate deficiency, vitamin A and D deficiency in children, adolescent girls and women. It will also aim to determine the severity of non-communicable disease related to nutrition. The survey is done by UNICEF, the Institute for Public Health Montenegro and GroundWork (Switzerland). The survey is supported by Ministry of Public Health of Montenegro and funded by the European Union.

We will ask questions about your household and the selected children and/or women living in the household. Individual questions will be asked to better understand each person's dietary habits and practices.

We would very much appreciate your participation in this survey. This information will help the government to plan health services. The questionnaire for you usually takes about 30 minutes to complete. Whatever information you provide will be kept strictly confidential and will not be shown to other persons.

Following the completion of the questionnaire, we will request to draw a small amount (i.e. 6 ml) of blood from all young children 6 to 59 months of age, non-pregnant women 15 to 49 years and pregnant women. For women, hypertension and waist circumference will also be measured.

The small blood sample will be collected to test for micronutrient deficiencies, such as iron, folate and vitamin A and vitamin D status, and for markers of inflammation and metabolic syndrome. Hypertension, high waist circumference, diabetes, low triglycerides and high-density lipoproteins are indicative of metabolic syndrome.

Benefits/risk of the study

Blood will be collected from individuals from the hand or arm vein using a needle. The blood will be collected by a trained paediatric nurse. The blood draw should take less than five minutes, and all the material used is single-use to ensure the highest hygiene standards. The blood draw could bring some temporary discomfort and, in very rare cases, lead to a haematoma (which typically disappears after one or two days). Other than that, this survey poses no risks to you or other participating family members.

The blood pressure of each woman will be measured three times, and if any measure indicates that the woman has hypertension, she will be informed by the nurse about this and she will be encouraged to seek further counselling from the nearest health facility. Results on anaemia and diabetes (women only) will be obtained within 48 hours and the results for each participating individual will be entered into Montenegro's online health card system, if available. If severe anaemia or diabetes is determined during laboratory testing, the laboratory staff will notify the survey team that collected the sample so that they can follow up directly with the affected individual. Importantly, our indicator of diabetes status (i.e. glycated haemoglobin/HbA1c can only be used for screening purposes for pregnant women in their second or third trimester. The MONS encourages pregnant women to use more comprehensive measures of gestational diabetes (e.g. oral glucose tolerance test) to make personal medical decisions.

Other than the information about whether one of your family members has hypertension, anaemia or diabetes, we cannot promise that the survey will help you directly. But the information we get will help the government to evaluate its nutrition and health services and if needed, to adapt them.

Confidentiality

All information that is collected about you and your household during the course of the interview will be kept strictly confidential, and any information about you and the household's address will not be included in the final report so that you cannot be recognized.

Only the personnel doing the interview, the principal researchers and the people in charge of entering the information into the Montenegro health card system will have access to identifiable information and, by providing your signature, you allow the research team to do so. If you do not want to provide your health card ID number, you can still participate in the survey.

Compensation

Your participation in this interview is important and we do appreciate the time made available. As mentioned earlier, the results of certain biological tests will be put on the online health portal so that you can use it for further counselling, if needed. No other financial or in-kind compensation will be offered.

Withdrawal from study

Participation in this survey is voluntary, and if we should come to any question you do not want to answer, just let me know and I will go on to the next question; or you can stop the interview at any time, without any consequences to you or your household. However, we hope that you will participate in this survey, since your views are important. There will not be any negative effects on you, if you decide that you no longer want to continue with the interview.

If you are younger than 18 years, your legal parent will have to give signed consent for your participation. This information sheet will be for you/your caretaker to keep. If you have any question, do not hesitate to contact the principal researchers.

Contact for additional Information

If you have any questions about the study, you are welcome to call the principal investigator (Dijana Đurović, Institute of Public Health)* or the national coordinator (Ida Ferdinandi, UNICEF Montenegro)* and they will be happy to answer your questions.

*The telephone numbers of Dr. Đurović and Ms. Ida Ferdinandi were provided in the information sheets distributed to the survey participants, but have been removed here in the report.

MONS – WRITTEN INFORMED CONSENT FORM

Complete this form for <u>one person only</u>; do NOT put information from two or more people on the same form!!

VOLUNTEER AGREEMENT

a. <u>Participation of individual below 18 years of age</u>

"I have read or have had someone read all information on the information sheet, have asked questions, received answers regarding participation in this study, and am willing to give consent for my child/ward to participate in this study. I have not waived any of my rights by signing this consent form. Prior to signing this consent form, I was given a copy of the information sheet for my personal records."

____

Name of mother or legal caregiver (if respondent is a minor)

____ ______________________

Signature or mark of mother or legal caregiver Date

b. <u>Adult woman's (i.e. 18+ years) own participation</u>

"I have read or have had someone read all information on the information sheet, have asked questions, received answers regarding participation in this study, and am willing to give consent to participate in this study. I have not waived any of my rights by signing this consent form. Prior to signing this consent form, I was given a copy of the information sheet for my personal records."

____

Name of participant

____ ______________________

Signature or mark of participant Date

CLUSTER ID: ☐☐☐

RESPONDENT LABEL: ☐☐☐☐☐ **HOUSEHOLD LABEL:**

8.7. TEAMS, TEAM MEMBERS, SUPERVISORS AND LISTERS

Team number	Doctors/ interviewers	Phlebotomist
Field teams		
1	Zorica Đorđević	Salija Fetić
2	Ivana Joksimović	Danilo Janjušević
3	Enisa Kujundžić	Marina Lakušić
4	Verica Osmanović	Milijana Bulatović
5	Marina Stamatović Savović	Zorica Đukanović
6	Anastasija Radunović	Tanja Leković
7	Snežana Barjaktarović Labović	Nina Radonjić
8	Vilnerina Ramčilović	Aldina Adžović
9	Ifeta Erović	Veselinka Novović
10	Ena Grbović	Ana Šoškić
11	Sabina Ćatić	Alma Paljević

Supervisors:

Dijana Đurović, IJZCG

Mladenka Vujošević, IJZCG

Ida Ferdinandi, UNICEF

Listers:

1. Zdenka Radović
2. Momira Džaković
3. Gabrijela Stanaj
4. Kata Elezović
5. Belma Muratović
6. Emina Pucar
7. Sead Pucar
8. Relja Vuković
9. Danijela Vuković
10. Goran Pješčić
11. Sanela Grbović
12. Marija Vukotić
13. Tanja Jovanović
14. Sanja Kralj
15. Vera Radović Pješčić

8.8. SURVEY QUESTIONNAIRE AND BIOLOGICAL FORMS

Main questionnaire

Montenegrin: https://groundworkhealth.org/wp-content/uploads/2023/07/MN_MONS-–-Main-Questionnaire-_-montenegro.pdf

English: https://groundworkhealth.org/wp-content/uploads/2023/06/MONS-–-Main-Questionnaire-_-KoboToolbox.pdf

Children's biological form

Montenegrin: https://groundworkhealth.org/wp-content/uploads/2023/07/MN_Preschool-Child-Biological-Form-_-montenegro.pdf

English: https://groundworkhealth.org/wp-content/uploads/2023/06/Preschool-Child-Biological-Form-_-KoboToolbox.pdf

Women's biological form

Montenegrin: https://groundworkhealth.org/wp-content/uploads/2023/07/MN_Woman-Biological-Form-_-montenegro.pdf

English: https://groundworkhealth.org/wp-content/uploads/2023/06/Woman-Biological-Form-_-KoboToolbox.pdf

Interviewer: Put household "P" label here	**BIOLOGICAL FORM – PRE-SCHOOL CHILD** **MONS 2022**	Interviewer: Put Child "D" label here

1. Strata / Region South .... 1 Central .... 2 North 3	2. Cluster number........................
3. Name of child:	4. Child age (months)........................
5. Child's Health ID Number:	6. Written informed consent given for phlebotomy? Yes ....1 No 2

BLOOD SAMPLE COLLECTION – ALL CHILDREN 6-59 MONTHS OF AGE	
Children should be seated on their caretakers lap or seated (older children) for blood collection	
7. Phlebotomist´s code number	Phlebo ID: ....
8. When did the child last eat? This includes breastfeeding. *This question is to be asked just before doing phlebotomy*	< 2 hours ....1 2-4 hours ....2 > 4 hours 3
9. Tube filling small 2ml tube	None .... 0 About ¼ .... 1 About ½ .... 2 About ¾ 3
10. Tube filling large 3ml tube	None .... 0 About ¼ .... 1 About ½ .... 2 About ¾ 3

OBSERVATIONS (THIS CAN BE LEFT BLANK IF NOTHING NOTABLE OCCURRED WITH BLOOD COLLECTION)
11. Observations:

Interviewer: Put household "P" label here	**BIOLOGICAL FORM - WOMAN** **MONS 2022**	Interviewer: Put Woman "Z" or "T" label here

1. Strata / Region — South ..... 1; Central ..... 2; North 3	2. Cluster number..... ☐☐☐
3. Name of woman: ________________	4. Is woman pregnant? Yes ....1; No 2
5. Woman's Health ID Number: ☐☐☐☐☐☐☐☐☐	6. Written informed consent given for biological measurements? Yes ....1; No 2

BLOOD PRESSURE AND BLOOD SAMPLE COLLECTION – NON-PREGNANT AND PREGNANT WOMEN	
Woman should be sitting down for blood pressure measurements and for blood collection	
7. Phlebotomist's code number	Phlebo ID: .... ☐☐
8. Blood pressure (mmHg) *Measure on woman's left arm*	***Reading 1*** A. Systolic ..... ☐☐☐ B. Diastolic ..... ☐☐☐ ***Reading 2*** C. Systolic ..... ☐☐☐ D. Diastolic ..... ☐☐☐ ***Reading 3*** E. Systolic ..... ☐☐☐ F. Diastolic ..... ☐☐☐ Not measured = 999
9. When did the woman last eat? *This question is to be asked just before doing phlebotomy*	< 2 hours ..... 1 2-4 hours ..... 2 > 4 hours 3
10. Tube filling small 2ml tube *This tube is taken for non-pregnant and pregnant women*	None ..... 0 About ¼ ..... 1 About ½ ..... 2 About ¾ 3
11. Tube filling large 4ml tube *This tube is taken for non-pregnant women, only*	None ..... 0 About ¼ ..... 1 About ½ ..... 2 About ¾ 3

8.9. REFERRAL FORM

REFERRAL FORM – MONS 2022

The Institute of Public Health and UNICEF are conducting the Montenegro Nutrition Survey (MONS) to better understand the nutritional status of women and children. As part of this, the survey teams are measuring hemoglobin (Hb) concentration of children 6-59 months old, women 15-49 years old, and pregnant women, and hypertension and diabetes status in non-pregnant and pregnant women.

Individuals receiving this referral form should visit a nearby health facility for further diagnosis and treatment, if required.

This form will be provided to individuals that have been identified as having the following conditions:

- Severe anemia: Hb <70 g/L for pregnant women and children; <80 g/L for non-pregnant women
- Hypertension: ≥140 mmhg (systolic) and/or ≥90 mmhg (diastolic) for all women
- Diabetes: HbA1c ≥ 6.5% for all women*

**For pregnant women in the second and third trimester, HbA1c can only be used for screening purposes, and more comprehensive measures of gestational diabetes should be used (e.g. oral glucose tolerance test).*

Person is (check one box): Pre-school child ☐ Non-pregnant woman ☐ Pregnant woman ☐	**Person's Name:** ___________________________
	Date of blood collection or blood pressure measurement: **(DD/MM/YY):** _____________________
	Hemoglobin concentration = ___________________g/L
	WOMEN ONLY: **Blood pressure (mmHg):** **Systolic:** ☐☐☐ **Diastolic:** ☐☐☐
	WOMEN ONLY: **HbA1c %:** ☐☐.☐

Name of referring phlebotomist or team leader: ____________________________

Mobile phone number of referring phlebotomist or team leader: ________________________

Date this form is provide to participant (DD/MM/YY): _________________

8.10. DESIGN EFFECTS OF MAJOR OUTCOMES

Table 61. Design effect of major outcome variables

Variable	Number in analysis	Design effect
Children 6–59 months of age		
Low birth weight	455	1.20
Had diarrhoea in past two weeks	466	1.26
Had fever in past two weeks	466	1.14
Had LRI in past two weeks	466	0.87
Early initiation of breastfeeding	108	1.17
Currently breastfeeding	145	0.92
Minimum dietary diversity	143	1.06
Anaemia	349	1.04
Iron deficiency	348	1.40
Vitamin D deficiency	336	0.99
Vitamin D deficiency or insufficiency	336	1.17
Non-pregnant women 15–49 years of age		
Took folic acid supplement in previous six months	1629	0.95
Took iron supplement in previous six months	1629	1.27
Took multi-vitamin supplement in previous six months	1633	2.58
Anaemia	1626	1.37
Iron deficiency	1602	1.18
Vitamin A deficiency	1602	0.91
Folate deficiency	1619	1.42
Vitamin D deficiency	1619	1.55
Vitamin D deficiency or insufficiency	1619	1.60
Diabetes mellitus	1625	0.82
Elevated triglycerides	1619	1.06
Low HDL cholesterol	1615	1.56
Visceral/central obesity	1629	1.98
Hypertension	1629	1.08
Pregnant women		
Took folic acid supplement in previous six months	65	0.80
Took iron supplement in previous six months	65	1.25
Took multi-vitamin supplement in previous six months	65	1.25
Anaemia	64	1.30
Vitamin D deficiency	64	1.06
Vitamin D deficiency or insufficiency	64	0.97
Diabetes mellitus	64	-
Elevated triglycerides	62	1.34
Low HDL cholesterol	63	0.98
Hypertension	64	1.01