Relationship in dietary habits variations during COVID-19 lockdown in Kosovo: The COVIDiet study

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A B S T R A C T

Changes in dietary habits and association with lifestyle during the coronavirus disease 2019 (COVID-19) lockdown in the Kosovo population have not been studied yet. Therefore, the intent of the present study was to determine whether if COVID-19 lockdown had any impact in lifestyle, including dietary habits and physical activity (PA) patterns of people from different areas of Kosovo. Dietary habits, PA, body weight and socio-demographic variables were measured through validated online survey started one week after lockdown decision and lasted for next two month (May and June 2020). Six hundred eighty-nine participants (women 79% and men 21%) aged between 20 and 65 years from the Kosovo territory participated in the research. Multivariate models showed that participants in family home residence, participants from Gjilan, participants female and participants with professional educations reported a higher likelihood of turning into a higher adherence to the Mediterranean diet (MedDiet) (OR: 6.09, 5.25, 5.17, 4.19, respectively). The weight gained during the lockdown was positively associated with a higher cooking frequency (OR; 2.90, p < 0.01), lower meat and fish consumption (OR; 1.15, p = 0.02; OR; 1.04, p = 0.04, respectively), higher fast-food consumption (OR; 0.49, p = 0.02) and no physical activity performance (OR; 0.43, p = 0.02) during the COVID-19 lockdown. The dietary habits during COVID-19 lockdown could be related to the improvements in adherence to the MedDiet and physical activities that may minimize related health complications.

1. Introduction

Investigations show that the lockdown during COVID-19 has had an inverse effect on psychological conditions such as psychological disturbance (Brooks et al., 2020). It has been associated with negative attitude changes involving a rise in smoking (45%), increased and decreased consumption of alcohol, weight gain or, uncontrolled eating of unhealthy food and snacks (Ammar et al., 2020; Anne et al., 2020; Carroll et al., 2020; Sidor & Rzymski, 2020). On March 13, 2020, the first cases of COVID-19 were recorded in Kosovo and according to the analysis of NIPHK (National Institute of Public Health of Kosovo) two people have tested positive for COVID-19, with stable health (Kosovo Government, 2020). From March to December, there were various measures and decisions which were taken by the Government of the Republic of Kosovo. The measures were strict, starting with closing and

moving at certain times making people spend a longer time with their families, preparing food and meals at home. Since some of the main food products consumed in this period were pastries and other sweets, this affected the increase in body weight. But over time the measures began to soften, the citizens began to move freely and continued with their work, until the second wave of the pandemic with more cases affected psychological, emotional and health condition (Kosovo Government, 2020). Changes in dietary habits were noticed during the lockdown reported by some research, evidenced a correlation between a higher Body Mass Index (BMI) and higher intake of junk food, snacks, and sugar drink during the lockdown (Ashby, 2020; Di Renzo et al., 2020; Pietrobelli et al., 2020). On the contrary, other research showed an adherence to a healthier diet during the first weeks of lockdown (Giacalone et al., 2020; Kriaucioniene et al., 2020; Rodríguez-Pérez et al., 2020). The relationship between diet and health is well-stablished,

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Table 1

Characteristics of the study population (%).

Characteristics	n	%
Gender		
Male	200	29
Female	488	71
Another	1	0.1
Group ages		
18–35	492	71
36–50	133	19
≥51	64	10
Education		
University	605	88
Lower	84	12
Body mass index		
<25 kg/m2	446	65
25–29 kg/m2	195	28
≥30 kg/m2	48	7
Weight gain during quarantine		
Gained	258	38
No changes/didn't know	431	62

Table 2

Standards characteristics of respondents by level of adherence to the MedDiet during the COVID-19 Kosovo confinement.

		Low (N = 339)		Medium (N = 325)		High (N = 25)		p Value[c]
		N	%	N	%	N	%	
Gender[a]								0.000
	Men	132	39	63	19	5	20	
	Woman	206	61	262	81	20	80	
	Another	1						
Place of Residence								0.089
	Family home	325	96	312	96	24	96	
	Alone	5	2	6	2	1	4	
	Student residence	8	2	2	1	0	0	
	Shared flat	1	0	5	1	0	0	
Region by Areas[b]								0.204
	Prishtina	184	54	193	59	14	56	
	Peja	37	11	36	11	3	12	
	Ferizaj	40	12	33	10	2	8	
	Prizren	24	7	17	5	2	8	
	Gjilan	16	5	19	6	3	12	
	Gjakova	24	7	13	4	0	0	
	Mitrovica	14	4	14	5	1	4	
Children in Care								0.004
	Yes	110	32	139	43	14	56	
	No	229	68	186	57	11	44	
Education Level								0.310
	Faculty	192	57	166	51	13	52	
	Master	75	22	87	27	9	36	
	Secondary	42	12	33	10	2	8	
	High	12	4	23	7	1	4	
	PhD	13	4	14	4	0	0	
	Elementary	5	1	2	1	0	0	
Age								0.429
	<20	50	15	35	11	1	4	
	20–35	202	59	189	58	15	60	
	35–50	59	17	69	21	5	20	
	51–65	26	8	31	9	4	16	
	>65	2	1	1	1	0	0	

[a] Numbers do not add up because there were five respondents who reported another gender (data not shown).

[b] Kosovo Administrative regions.

[c] Differences between the three MedDiet adherences groups were evaluated by the Chi-squared test.
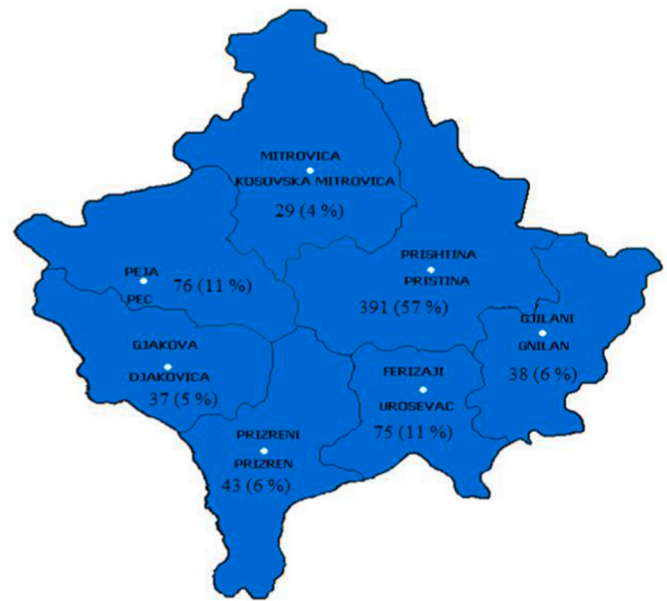

Fig. 1. Districts of Kosovo.

thus, nutritional behavior threatens the health and therefore managing an excellent diet is essential for boosting the immune system (Kriaucioniene et al., 2020). Indeed, serious obesity is one of the groups with the highest risk for COVID-19 difficulties because the adipose tissue contributes to the inflammatory medium and oxidative stress level (Di Renzo et al., 2019; USA Government, 2020).

The MedDiet is made of a perfect mix of good foods, containing all macro and micronutrients, which is the key factor against inflammatory responses, due to their low cholesterol levels and high levels of antioxidants and monounsaturated fatty acid (De Lorenzo et al., 2017). Moreover, Rodríguez-Pérez et al. (2020) reported that a higher MedDiet adherence could have a positive impact on the prevention of COVID-19-related complications. Therefore, taking this into consideration, the purpose of this research was to investigate self-reported nutritional behavior and weight gain/physical activity performance during the COVID-19 lockdown among a representative adult population from Kosovo and to evaluate socio-demographic variance in nutrition and eating behaviors.

2. Materials and methods

2.1. Study sample and data collection

The online cross-sectional survey was carried out between individuals older than 18 years in Kosovo as part of the international COVIDiet (COVIDiet_Int) project with ID number: NCT04449731 (https://clinicaltrials.gov/ct2/show/NCT04449731) managed by the University of Granada, Spain (Rodríguez-Pérez et al., 2020). The survey began on 5 May; a week after COVID-19 lockdown started in Kosovo and lasted eight weeks. A self-administered anonymous web-based questionnaire was developed to collect data. The respondents were grouped into five age groups: under 20 years, 20–35 years, 35–50 years, 51–65, and older (over 65). Education level respondents were categorized into six groups: primary, secondary, high, bachelor, master, and Ph.D. level of education. The full questionnaire is available online at https://www.mdpi.com/2072-6643/12/6/1730/s1 (the Albanian translation can be obtained from the authors upon request). Briefly, three main sections of the items were divided as follow (1) Socio-demographic information questions (sex, age, place of residence, country, dependent children, level of studies), (2) PREDIMED MedDiet Adherence Screener (14 questions of MEDAS) (Martínez-González et al., 2012) and actual
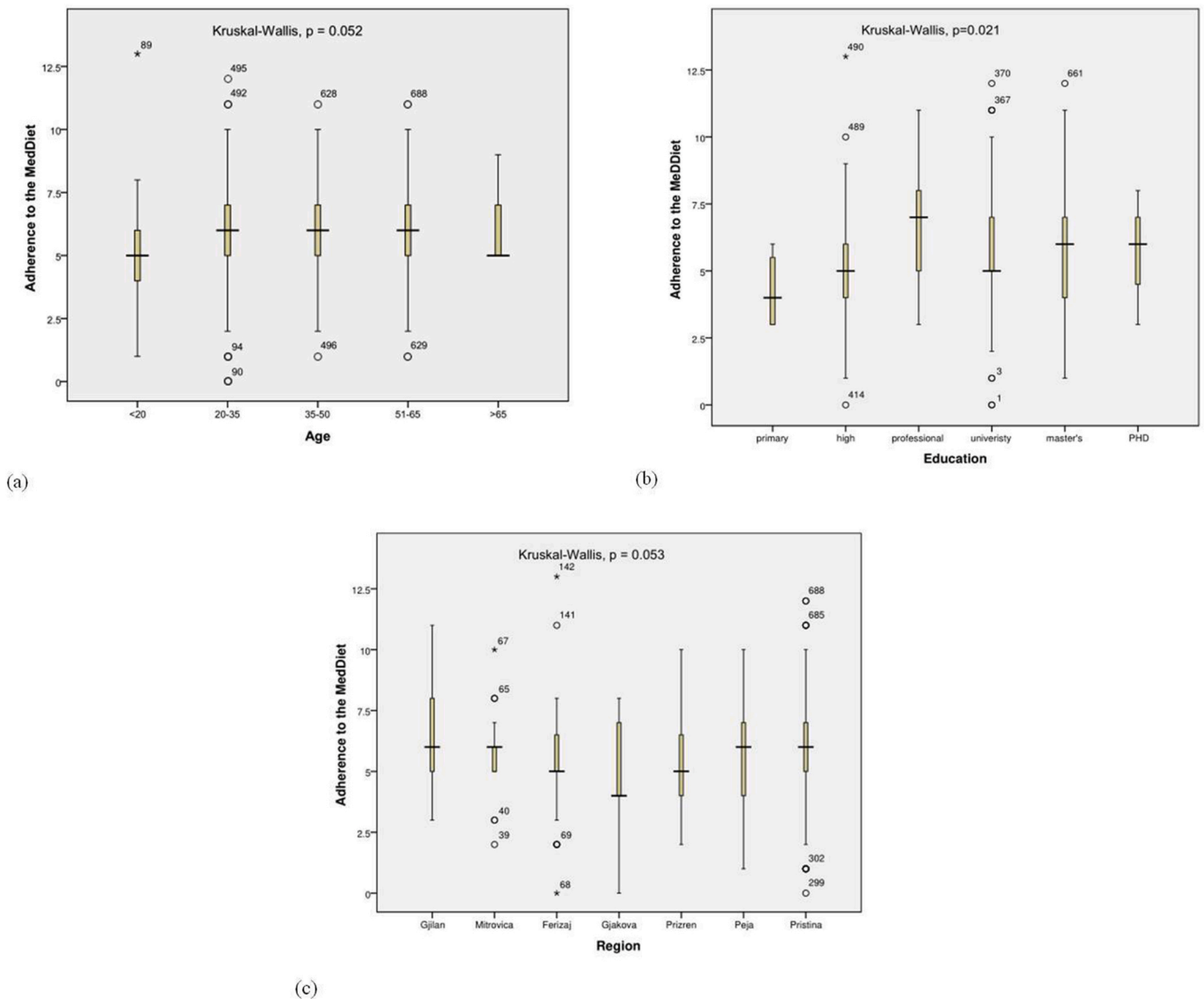
Fig. 2. Adherence to the MedDiet during the Kosovo COVID-19 lockdown by subgroups of age (a), educational level (b) and region (c).

changes and lastly (3) 21 questions with the purpose to research variation during regular eating habits throughout the lockdown, i.e., frequency and way of cooking, type of oil for frying, alcohol intake, snacking, between others. All items were also arranged to realize if contributors decreased, increased, or maintained their routine during the COVID-19 lockdown. Also, physical activity and body weight changes were assessed through two questions. The link to the survey was disseminated using social networking sites, web-pages of some institutions, which agreed to participate and social media such as Facebook, with the intention of reaching the highest number of participants from all administrative districts of Kosovo.

2.2. Ethical issues

The international COVIDiet study was approved by the Research Ethics Committee of the University of Granada (1526/CEIH/2020). Additionally, the Kosovo COVIDiet study was approved by the Bioethics Centre of the University of Tetova. Participation was voluntary, anonymous and no personal data were collected. The participants were informed about the objectives of the study.

2.3. Statistical analyses

Descriptive statistics for all the collected variables were derived by levels of adherence to the MedDiet and by sex, age, level of education, and region. Student's t-test or Kruskal-Wallis test (for continuous normal or non-normal distributed data, respectively), and Chi-squared tests (for categorical data) were used to evaluate differences in means or proportions by these variables across the strata. Box-plots were also used to evaluate further the distribution of the variable on adherence to the MedDiet by the aforementioned subgroups. Adherence to the MedDiet was assessed on the continuous scale (range: 0–14) and on the categorical scale by classifying participants into low, medium, and high adherence levels (<5, 6 to 8 and > 9 points, respectively) to the MedDiet at the two-time points: before and during the COVID-19 Kosovo lockdown. A binary variable to assess the change in adherence to the MedDiet was built to distinguish between those who kept adherence to the MedDiet alike (reference category, set to zero) and those who changed their adherence towards a greater adherence (set to one). Logistic regression models were used to explore variables associated with the change in adherence (change versus non-change, as reference) to the MedDiet. Odds ratios (ORs) and corresponding 95% Confidence Intervals (CIs) were estimated in univariate regression models. The

Table 3
Dietary and lifestyle adjustment by level of adherence to the MedDiet during the COVID-19 Kosovo confinement.

	All (N = 689)		Low (N = 339)		Medium (N = 325)		High (N = 25)		*p*-Value
	N	**%**	N	%	N	%	N	%	
Meals out of home									0.174
0	112	16	51	15	58	18	3	12	
1	193	28	90	26	97	30	6	24	
2	273	40	131	39	128	39	14	56	
3	111	16	67	20	42	13	2	8	
Alcohol intake									0.003
As before	362	52	174	51	176	54	12	48	
Lower	299	43	156	46	136	42	7	28	
Higher	28	4	9	3	13	4	6	24	
Type of Cooking									0.104
Microwave	6	1	2	1	4	1	0	0	
Bake	205	30	116	34	79	24	10	40	
Fried	54	8	31	9	21	7	2	8	
Frying	58	8	24	7	32	10	2	8	
Boiling	366	53	166	49	189	58	11	44	
Frequency of Cooking									0.150
As before	255	37	131	39	119	36	5	20	
Lower	49	7	26	8	22	7	1	4	
Higher	385	56	182	53	184	57	19	76	
Fried Foods Intake									0.678
As before	355	52	184	54	156	48	15	60	
Lower	174	25	79	23	90	28	5	20	
Higher	160	23	76	23	79	24	5	20	
Fried Foods Frequency Per Week									0.718
<1	178	26	80	24	91	28	7	28	
1–3	392	57	201	58	178	55	13	52	
4–6	77	11	36	10	37	11	4	16	
Never	34	5	19	7	15	5	0	0	
>7	8	1	3	1	4	1	1	4	
Oil used for frying									0.744
Another	15	2	6	2	8	2	1	4	
Canola Oil	3	0	1	0	2	1	0	0	
Sunflower Oil	355	52	175	52	168	52	12	48	
Corn Oil	85	12	35	10	45	14	5	20	
Olive Oil	231	34	122	36	102	31	7	28	
Snacking frequency									0.940
As before	311	45	151	44	152	47	8	32	
Lower	139	20	68	21	65	19	6	24	
Higher	239	35	120	35	108	34	11	44	
Fast food frequency									0.022
As before	243	35	105	31	127	40	11	44	
Lower	352	51	190	56	151	46	11	44	
Higher	94	14	44	13	47	14	3	12	
Eating more									0.616
upper/yes	262	38	131	39	123	38	8	32	
lower/no	427	62	208	61	202	62	17	68	
Physical activity									0.275
As before	190	28	100	29	85	26	5	20	
Lower	283	41	129	38	143	44	11	44	
Upper	152	22	71	21	73	22	8	32	
Never	64	9	39	12	24	8	1	4	
Weight gain									0.436
Yes	258	37	119	35	124	38	15	24	
Unknown	109	16	56	17	50	15	3	12	
No	322	47	164	48	151	47	7	28	

[1]Numbers do not add up because there were five respondents who reported another gender (data not shown).
[2]Kosovo Administrative regions.
[3]Differences between the three MedDiet adherences groups were evaluated by the Chi-squared test.

threshold for statistical significance in two-sided tests was set at p-value = 0.05. Data were analyzed with SPSS (version16.0).

3. Results and discussion

3.1. Sociodemographic and regional characteristics of the study sample

In total, 689 individuals from Kosovo (488 females and 200 males) participated in the survey and completed the questionnaire (Table 1). Most participants were 20–35 years old (59%) and the highest percentage of the sample had university studies (54%), were living in the family home (56.7%), and with no children in care (62%) (Table 2). About 71% of the participants were females, 57% were from the district of Pristina (Fig. 1), and only few participants became from the oldest (0.4%) and middle oldest age groups (8.8%). No statistical difference was found for participants that were more likely to live in family homes, and no significant differences by regions between gender levels were noted (except for Mitrovica). However, a statistically significant interaction by gender was observed between change in adherence to the MedDiet and children in care (p-value = 0.000 and 0.004, respectively).

Table 4
Dietary behaviors relative to the MedDiet pattern during the COVID-19 Kosovo lockdown.

MEDAS Food	All		Low		Medium		High		
	(N = 689)		(N = 339)		(N = 325)		(N = 25)		*p*-Value
	N	%	N	%	N	%	N	%	
Olive Oil									0.402
As before	464	67	218	64	229	70	17	68	
Lower	67	10	37	11	29	9	1	4	
Higher	158	23	84	25	67	21	7	28	
Vegetables									0.835
As before	318	46	159	47	148	45	11	44	
Lower	29	4	12	3	15	5	2	8	
Higher	342	50	168	50	162	50	12	48	
Fruits									0.739
As before	293	43	136	40	150	46	7	28	
Lower	43	6	23	7	18	6	2	8	
Higher	353	51	180	53	157	48	16	64	
Red Meat									0.121
As before	324	48	151	44	158	49	15	60	
Lower	261	37	144	43	112	34	5	20	
Higher	104	15	44	13	55	17	5	20	
Sweet Beverages									0.003
As before	278	40	124	36	142	44	12	48	
Lower	257	37	149	44	101	31	7	28	
Higher	154	23	66	20	82	25	6	24	
Legumes									0.188
As before	518	75	253	75	247	76	18	72	
Lower	74	11	44	13	28	9	2	8	
Higher	97	14	42	12	50	15	5	20	
Fish									0.102
As before	495	72	243	72	235	72	17	68	
Lower	121	18	67	20	51	16	3	12	
Higher	73	10	29	8	39	12	5	20	
Non-homemade Pastries									0.128
As before	297	43	132	39	153	47	12	48	
Lower	153	22	87	26	61	19	5	20	
Higher	239	35	120	35	111	34	8	32	

Differences between the MedDiet adherence groups (low. medium and high) were evaluated by the Chi-squared test.

According to Table 5, positive answers to the MEDAS questionnaire and the adherence to MD are reported in terms of territorial coverage over the Kosovo administrative districts. Results from the MEDAS questionnaire in our population sample, classified according to the regional participation, demonstrated significantly variations (p = 0.018) and that most of subjects had more than 50% of olive oil (61% in Gjilan, 57% in Pristina, 55% in Mitrovica, and 51% in Gjakova). Olive oil consumption has been traditionally highlighted to contribute to the prosperity well-being of the Mediterranean people, and nowadays there is consistent evidence supporting its association with lower all-cause mortality and reduced risk of cardio vascular disease (Campanini et al., 2017). The highest percentage of the study samples consumed 1–2 portions of vegetables per day (51%), 1–3 fruits per day (53%), and legumes 1 time per week (47%) with no significant difference between the regions were found. Regarding vegetable consumption, results from the MEDAS questionnaire showed that more than 50% increased their intake only the region of Pristina (54%) while the increase of fruits consumption was higher in the regions from Prizren (63%), Ferizaj (61%) and Gjilan (58%). Our finding pertaining higher fruit and vegetable consumption during Kosovo COVID-19 lockdown were inconsistent with the previous findings which reported the opposite trend (Amar et al., 2020; Deschasaux-Tanguy et al., 2020; Di Renzo et al., 2020; Pellegrini et al., 2020). Fruits and vegetables are rich in Zinc which is a necessary mineral in the maintenance and growth of adaptive and innate immune cells (Bonaventura et al., 2015). In agreement to the Italian study, positive changes related to the decrease of meat consumption, carbonated or sugary drinks and increased consumption of fresh fruits and vegetables were

reported during the COVID-19 lockdown (Di Renzo et al., 2020; Rodríguez-Pérez et al., 2020). The lower consumption of meat could be related with the lack of stock in some supermarkets, the same that happened in the Spanish supermarkets and grocery stores after the state of alarm was declared (Rodríguez-Pérez et al., 2020). Vieux et al. (2018) stated that meat consumption is proportional to the amount of greenhouse gas (GHGs) emissions whereas others declared that consumption of red meat has been associated with chronic diseases like cancer (Springmann et al., 2018). The chi-square test showed differences in MEDAS score among the seven Kosova regions (p = 0.204), with higher scores in Gjilan and Prizren when compared to other administrative regions.

3.2. Dietary behaviours during the COVID-19 confinement

Socio-demographic factors associated with the change in the adherence to the MedDiet are presented in Table 6. Multivariate models found that female participants (OR: 5.17), participants lived in the family home (OR: 6.09), participants with high education level and participants with ages from 51 to higher than 65 years old (OR < 0.70) presented a higher odd of change to adhere to the MedDiet during the lockdown. On the contrary PhD respondents (OR: 0.04) and those who lived alone (OR: 0.99) from Gjakova had lower adherence to the MedDiet (Table 6). Kruskal Walli's analysis showed that no significant association was observed between the change in MedDiet adherence and the age and region but the level of education showed significant association to the change in MedDiet adherence (Fig. 2). So the age and geographical region were not found to modify the associations with adherence. Dietary and lifestyle adaptations by gender during the COVID-19 Kosovo lockdown are shown in Table 3. Overall, most participants did not increase their intake of alcohol level (52% maintained it and 43% decreased it), as well as their physical activity level (41%) which remained lower during the lockdown. Furthermore, the majority cooked in a higher frequency than before the lockdown and used boiling as the main technique for cooking (53%). The intake of snacks and fried foods was reported similar as before COVID-19 lockdown for 45% and 52% of participants, respectively while 51% of participants showed significant (p < 0.05) lower frequency of fast-food intake. However, around 57% of the participants continued consuming fried foods 1–3 days a week and around 32%, more than 7 times per week. Similarly to the Spanish COVIDiet Study (Rodríguez-Pérez et al., 2020), 62% of participant reported not to eat more during the lockdown. The greater part of the participants (52%) used sunflower oil for frying. In contrast to our results, a study conducted in Spanish adults reported that the subjects increased consumption of olive oil during lockdown (Reyes-Olavarría et al., 2020). Concerning anthropometric principle, 37% of the participants reported weight gain and 47% reported the opposite with a higher prevalence in female participants (68.9%). According to the World Health Organization (WHO) guidelines, overweight was defined as BMI 25–29 kg/m2 and obesity as BMI ≥ 30 kg/m2 (WHO, 2000). The participants reported a lower PA (times/week and min/session, p > 0.05) than before lockdown.

Changes in the MedDiet adherences and association of variables with Body weight Increase.

From the Chi-square test analyses, it is obvious that age, children in care, alcohol intake, fast food frequency, and sweet beverage consumption were significantly associated with adherence to the MeDdiet levels (Tables 2–4). According to changes in eating habits (Table 4), the highest percentage of the study sample consumed the same olive oil (67.34%), legumes (75.18%) and higher portions of vegetables (49.6%), and fruits (51.24%) per day as before lockdown. Regarding meat consumption, 47.9% consumed red meat as before, and 71.84% consumed fish as before the lockdown. Also, the highest percentage of participants declared no change in the consumption of non-homemade pastries (43.1%) and sweet beverages (40.34%) that was statistically significant (p < 0.003) (Table 4). Since dietary and lifestyle habits changed, several

Table 5
Comparisons between dietary behaviours relative to the MedDiet pattern by region during the COVID-19 Kosovo lockdown.

	Total	Ferizaj	Gjakova	Gjilan	Mitrovica	Peja	Pristina	Prizren	p-Value
	(689)	75 (10.9)	37 (5.4)	38 (5.5)	29 (4.2)	776 (11)	391 (56.8)	43 (6.2)	
Olive oil for cooking									0.018
Yes	361 (52)	32 (43)	19 (51)	23 (61)	16 (55)	28 (37)	223 (57)	20 (47)	
No	328 (48)	43 (57)	18 (49)	15 (39)	13 (45)	48 (63)	168 (43)	23 (53)	
Olive oil (tablespoons/d)									0.243
>4	169 (25)	13 (17)	6 (16)	12 (32)	8 (28)	18 (24)	106 (27)	6 (13)	
2–3.9	242 (35)	27 (36)	12 (32)	9 (24)	10 (34)	22 (28)	145 (37)	17 (40)	
0–1.9	278 (40)	35 (47)	19 (52)	17 (44)	11 (38)	36 (47)	140 (36)	20 (47)	
Vegetables (servings/d)									0.289
>2	222 (32)	30 (40)	14 (38)	8 (21)	9 (31)	27 (36)	120 (31)	14 (33)	
1–1.9	354 (51)	35 (47)	18 (49)	17 (45)	14 (48)	37 (48)	212 (54)	21 (49)	
0–0.9	113 (17)	10 (13)	5 (14)	13 (34)	6 (21)	12 (16)	59 (15)	8 (18)	
Fruits (units/d)									0.346
>3	211 (31)	15 (20)	13 (35)	12 (32)	11 (38)	24 (32)	127 (32)	9 (21)	
1–2.9	356 (52)	46 (61)	19 (51)	22 (58)	16 (55)	36 (47)	190 (49)	27 (63)	
0–0.9	122 (17)	14 (19)	5 (14)	4 (10)	2 (7)	16 (21)	74 (19)	7 (16)	
Red meat (servings/d)									0.487
>1	248 (36)	24 (32)	19 (51)	12 (34)	11 (38)	29 (38)	140 (36)	13 (30)	
0–0.9	441 (64)	51 (68)	18 (49)	26 (68)	18 (62)	47 (62)	251 (64)	30 (70)	
Fats (servings/d)									0.201
>1	146 (21)	14 (19)	14 (38)	5 (13)	6 (21)	16 (21)	84 (21)	7 (16)	
0–0.9	543 (79)	61 (81)	23 (62)	33 (87)	23 (79)	60 (79)	307 (79)	36 (84)	
Sweet beverages (servings/d)									0.074
>1	244 (35)	27 (36)	13 (35)	11 (29)	14 (48)	38 (50)	127 (32)	14 (33)	
0–0.9	445 (65)	48 (64)	24 (65)	27 (71)	15 (52)	38 (50)	264 (68)	29 (67)	
Wine (glasses/d)									0.072
0	509 (74)	61 (81)	31 (84)	28 (74)	26 (90)	47 (62)	283 (71)	33 (77)	
>7	9 (1)	1 (1)	0 (0)	0 (0)	0 (0)	3 (4)	4 (1)	1 (2)	
3–6.9	20(3)	0 (0)	1 (3)	1(3)	2 (7)	1 (1)	15 (4)	0 (0)	
0–2.9	151 (22)	13 (18)	5 (13)	9 (23)	1 (3)	25 (33)	89 (23)	9 (21)	
Legumes (servings/w)									0.701
>3	74 (10)	10 (13)	1 (3)	6 (16)	4 (14)	9 (12)	37 (8)	7 (16)	
1–2.9	294 (43)	33 (44)	16 (43)	19 (50)	12 (41)	32 (42)	167 (43)	15 (35)	
0–0.9	321 (47)	32 (43)	20 (54)	13 (34)	13 (45)	35 (46)	187 (48)	21 (49)	
Fish (servings/w)									0.165
>3	36 (5)	3 (4)	1 (3)	2 (5)	1 (4)	7 (9)	16 (4)	6 (14)	
1–2.9	252 (37)	28 (37)	13 (35)	15 (39)	16 (55)	22 (29)	144 (37)	14 (33)	
0–0.9	401 (58)	44 (59)	23 (62)	21 (56)	12 (41)	47 (62)	231 (59)	23 (53)	
Non-homemade pastries (units/w)									0.021
>2	291 (42)	29 (39)	18 (49)	14 (37)	11 (38)	47 (62)	155 (40)	17 (40)	
0–1.9	398 (58)	46 (61)	19 (51)	24 (63)	18 (62)	29 (38)	236 (60)	26 (60)	
Nuts (servings/w)									0.016
3	133 (19)	8 (11)	4 (11)	12 (32)	4 (14)	20 (26)	79 (20)	6 (14)	
1–2.9	245 (36)	33 (44)	12 (32)	13 (34)	17 (58)	28 (37)	130 (33)	12 (28)	
0–0.9	311 (45)	34 (45)	21 (57)	13 (34)	8 (28)	28 (37)	182 (47)	25 (58)	
White meat preference									0.973
yes	540 (78)	58 (77)	27 (73)	29 (76)	23 (79)	62 (82)	307 (79)	34 (79)	
no	149 (22)	17 (23)	10 (27)	9 (24)	6 (21)	14 (18)	84 (21)	9 (21)	
Sofrito3 (servings/w)									0.109
>2	350 (51)	34 (45)	13 (35)	19 (50)	15 (52)	49 (65)	202 (52)	18 (41)	
1–1.9	217 (31)	30 (40)	19 (51)	11 (29)	8 (28)	16 (21)	119 (30)	14 (33)	
0–0.9	122 (18)	11 (15)	5 (14)	8 (21)	6 (20)	11 (14)	70 (18)	11 (26)	
Adherence to the MD									
Low	339 (49)	40 (53)	24 (65)	16 (42)	14 (48)	37 (49)	184 (47)	24 (56)	
Medium	289 (42)	33 (44)	13 (35)	19 (50)	14 (48)	36 (47)	193 (49)	16 (37)	
High	61(9)	2 (3)	0 (0)	3 (8)	1 (3)	3 (4)	14 (4)	3 (7)	

Positive answers to MEDAS questionnaire. Compliance rates of at least 50% are indicated in bold. Data are expressed as number and percentage in parenthesis (n %). Differences between the regions groups were evaluated by the Chi-squared test (p < 0.05).

food choices were associated with the change in weight gain during lockdown (Table 7). Multivariate-adjusted models showed that those participants who reported a lower intake of meat (OR: 0.79, 95% IC: 0.65–0.97) during the COVID-19 Kosovo lockdown had a statistically significant higher likelihood of gaining weight because of higher consumption of bakery products compared to those who eat higher meat portion during the lockdown. Similarly, OR associated with weight gain increased significantly in respondents who had a lower intake of pan fried trout fish weekly (OR: 1.04 95% IC: 0.99–1.08). Also, a significantly higher odds (OR: 0.43; 95% CI: 0.21–0.87) of changing, respectively gaining weight during lockdown, compared to those who kept being with lower activity or inactive respondents was found. There was a

significant inverse correlation between higher BMI and olive oil intake and obviously weight gain was significantly correlated with eating more during the COVID-19 lockdown than before (data not shown). Table 6 displays multivariate-adjusted ORs associated with the change in adherence to MedDiet in relation to the MEDAS-derived foods, considering mutual adjustment by each other food item. The weight gain was associated with the BMI of participants which means that those with higher BMI gained weight more often compared to those having normal BMI (Fig. 3). The logistic regression showed that women were more likely to be associated with higher adherence to MedDiet during the COVID-19 lockdown (Table 6). Similarly Bouzas et al. (2020), reported that women participants had higher desired weight loss, related to

Table 6
Factors associated with adherence to the MedDiet during Kosovo lockdown.

		High vs medium - low adherence to MedDiert	
		Crude Model	
		OR	95% CI
Gender			
	Male	Ref	Ref
	Female	5.17	[2.04–13.10]
	Another	0.0	0.0
Place of Residence			
	Shared flat	Ref	Ref
	Family home	6.09	0.00
	Student residence	1.00	0.00
	Alone	0.99	0.00
Region by Areas			
	Mitrovica	Ref	Ref
	Gjilan	5.25	0.59–46.30
	Pristina	3.19	0.42–24.08
	Ferizaj	0.77	0.67–8.80
	Gjakova	0.00	0.00–0.00
	Prizren	2.10	0.21–21.24
	Peja	3.76	0.45–31.10
Children in Care*			
	No	Ref	Ref
	Yes	0.52	[0.31–0.89]
Education Level			
	Elementary	Ref	Ref
	Secondary	1.81	[0.20–16.19]
	High	4.19	[0.46–38.20]
	University	2.29	[0.30–17.45]
	Master	3.66	[0.47–28.43]
	PhD	0.04	
Age			
	>65	Ref	Ref
	<20	0.17	[0.02–1.56]
	20–35	0.58	[0.19–1.80]
	35–50	0.45	[0.11–1.84]
	51–65	0.70	0.00

Table 7
The proportion of participants changes in health behaviours by changes in weight (%) and Odds Ratios (OR) for the likelihood of weight gain.

		Logistic regression			
		Gained	No Changes/ Doesn't Know	OR (95% CI)	p-Value
Sex				1.02 (0.72–1.43)	0.921
	Male	31.1	28.5		–
	Female	68.9	71.3		–
	Another	0	0.2		–
Meat ratio				0.67 (0.50–0.94)	0.030
	Under 1	58.4	67.1	1.15 (1.02–1.31)	0.021
	Upper	41.6	32.9	0.79 (0.65–0.97)	–
Fish ratio				1.95 (0.99–3.82)	0.058
	Upper 3	7.4	3.9	0.53 (0.28–1.01)	0.049
	Under	92.6	96.1	1.04 (0.99–1.08)	–
Olive oil				0.80 (0.59–1.09)	0.791
	Lower	10.9	9	1	–
	No change	70.8	65.3	1.21 (0.59–2.45)	0.602
	Higher	18.3	25.7	1.19 (0.71–1.99)	0.500
Vegetable				1.17 (0.87–1.57)	0.771
	Lower	3.1	4.9	1	–
	No change	44	47.5	0.77 (0.32–1.89)	0.578
	Higher	52.9	47.7	0.90 (0.63–1.28)	0.567
Pasta				1.11 (0.89–1.39)	0.366
	Lower	17.5	25	1	–
	No change	48.2	40	0.76 (0.44–1.29)	0.311
	Higher	34.2	35	1.13 (0.76–1.67)	0.537
Fish					0.602
	Lower	20.6	16.7	1	–
	No change	67.7	73.1	1.08 (0.60–1.95)	0.778
	Higher	11.7	10.2	0.88 (0.52–1.47)	0.637
Beverage Sweet					0.229
	Lower	32.7	40	1	–
	No change	44.7	37.7	0.80 (0.52–1.21)	0.301
	Higher	22.6	22.2	1.10 (0.72–1.67)	0.645
Physical activity					0.000
	No change	18.3	33.1	1	
	Lower	52.9	34.0	0.38 (0.19–0.77)	0.007
	Higher	16.7	25.2	0.87 (0.45–1.65)	0.667
	No activity	12.1	7.6	0.43 (0.21–0.87)	0.020
Fast Food					0.023
	No change	28.4	39.4	1	
	Lower	47.9	53.0	0.42 (0.22–0.79)	0.007
	Higher	23.7	7.6	0.49 (0.28–0.88)	0.017
Snack Eating	No change	35.4	50.7	1	0.171
	Lower	19.5	20.6	0.91 (0.58–1.40)	
	Higher	45.1	28.7		

(*continued on next page*)

higher education levels. Moreover, weight management has been associated with a higher consumption of fruits and vegetables, especially in women (Kuk et al., 2009; Rodríguez-Rodríguez et al., 2009; Romieu et al., 2012; Tsai et al., 2016). No associations were found with age and education of respondents. In multivariate logistic regression analyses, the association of weight gain with the increased intake of fast food, eating more, no physical activity and higher frequency of cooking remained statistically significant. Also, the odds of weight gain also increased with higher pastries intake, higher beverage or sugary drinks, and increased snacking intake. The main strength of this project was the cooperation of scientists from different countries and many disciplines which were widely distributed in several countries. The investigation exceeded the minimum sample size of 385 participants with 5% of margin of error and the confidence of 95% and provides novel results applicable to lockdown times and after. The common limitation in the field of behavioral nutrition research which uses surveys that measures dietary behaviors has relied on self-reported survey studies and the validity of answers is a general problem. The second limitation is its cross-sectional design; and the use of unvalidated measures such as self-reported body weight and physical activity level.

4. Conclusion

This is the first study targeted on assessment of changes in eating behavior in a Kosovo adult population during the COVID-19 lockdown. Overall, our results highlighted that most participants decreased unhealthy nutritional behaviors and physical activity level during the lockdown. Furthermore, the majority of participants increased fruits and vegetable consumption and cooking frequency being boiling the main employed technique. The weight gained during the lockdown presented positive association with the higher frequency of cooking than before

Table 7 (*continued*)

	Logistic regression			
	Gained	No Changes/ Doesn't Know	OR (95% CI)	p-Value
			1.52 (0.87–2.63)	
Frequent cooking			0.92 (0.76–1.10)	0.009
No change	1.9	2.3	1	
Lower	0.4	0.5	0.85 (0.55–1.31)	
Higher	54.9	49.5	2.90 (1.37–6.11)	
Often Eating				0.000
No			1	
Yes			0.10 (0.06–0.16)	
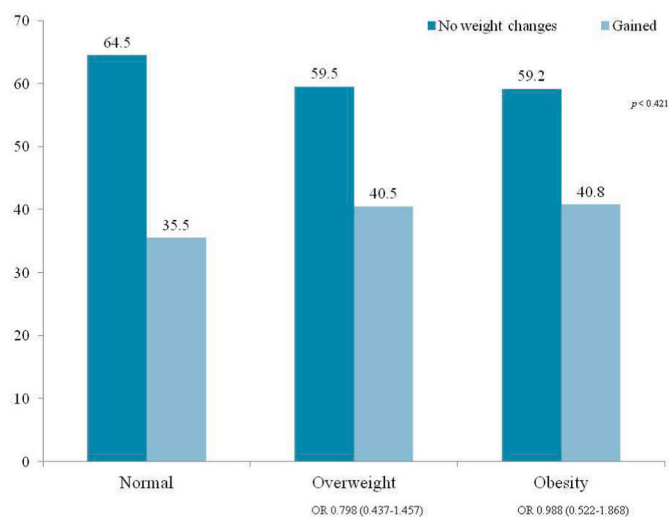
Fig. 3. Association between body mass index (BMI) of the participants and weight gain during the lockdown (%).

the lockdown started. However, the present study is considered as a preliminary description of the assessment of nutritional status and identification of potential risk factors of the negative eating behaviors highlighted the importance with intention of making possible nutritional intervention for healthy lifestyle improving. Our intention is to highlight the need for better promotion of general well-being with future studies assessing maintains after the lockdown.

Author contributions

ES analyzed the data and wrote the manuscript. AH and GXh collected the data while CRP designed the data and provided critical feedback on the manuscript. All authors read and ensured input on the manuscript before approving.

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Ethical statement

The studies involving human participants were reviewed and approved by Research Ethics Committee of the University of Granada.

The patients/participants provided their written informed consent to participate in this study.

Declarations of competing interest

None.

Ethics

The international COVIDiet study was approved by the Research Ethics Committee of the University of Granada (1526/CEIH/2020). Additionally, the Kosovo study was approved by the Bioethics Centre of the University of Tetova. This study is anonymous and it follows the existing regulations regarding Confidentiality and Data Protection Policy (Spanish Organic Law of Personal Data Protection (LOPD) 15/1999). The following questionnaire is addressed to the adult citizens of Kosovo, who by answering the questions provide their consent for their voluntary participation in the study. The questionnaire has been translated to 14 different languages and the study is being conducted in 18 countries simultaneously.

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