DIETARY SUSTAINABILITY: GREENHOUSE GAS EMISSIONS RESULTING FROM DIETARY INTAKE IN TYROL, AUSTRIA

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Abstract. In the course of the Tyrolean Nutrition Survey representative health and nutrition related data from the Tyrolean regions of Innsbruck Stadt and Innsbruck Land (NUTS-3 region) are collected. The aim is to create a database in Tyrol at regular intervals to monitor diet-related trends and problems in order to initiate targeted measures. Another aim is to assess dietary sustainability in Tyrol focusing on the dimensions of health and environment. Within the scope of the Tyrolean Nutrition Survey 2015 (Tiroler Ernährungserhebung 2015) data on eating and exercise habits, anthropometric measurements and body composition analysis of 463 participants were collected. In order to assess the food intake, the participants were asked what they had to drink and eat in a 24-hour period on two non-consecutive days. To calculate dietary sustainability, the consumption data was linked with food-related CO_2 equivalents in kilograms ($kgCO_{2e}$). The results show that 42 % of nutrition-related greenhouse gas emissions come from the consumption of milk and dairy products along with meat and meat products. The findings in Tyrol also demonstrate, that a reduced consumption of animal-based products is necessary to lower diet-related-environmental impacts. Currently, the Tyrolean Nutrition Survey 2021 is carried out, with the aim to assess nutrition-related impacts on health and environment even further.

Keywords: nutrition survey, dietary intake, dietary sustainability

INTRODUCTION

The Food and Agriculture Organisation (FAO) defines sustainable diets as those diets with low environmental impacts, which contribute to food and nutrition security and to a healthy life for present and future generations [1]. In recent years, food systems have changed due to population growth, urbanization, growing wealth, changing consumption patterns and globalization which have also influenced our dietary habits and food choices resulting in the high consumption of animal-derived foods and highly processed foods or refined sugars [2, 3]. On the one hand, high intake of those foods are known for their negative impact on our health by increasing the risk of developing diet-related diseases such as obesity, high blood pressure, coronary heart disease, stroke, and diabetes. On the other hand those foods also have a negative impact on the environment [4–6]. Nearly one third of the global greenhouse gas emissions (GHGEs) are caused by our food systems and therefore, are partly responsible for exceeding planetary boundaries [5, 7].

To lower GHGEs and to meet present and future food needs, a shift of individual and population based dietary choices and patterns is necessary. In order to identify where measures need to be taken, it is necessary to assess how current dietary patterns and food choices in populations look like. The Tyrolean Nutrition Survey [8, 9] aims to monitor dietary intake and health and nutritional status periodically. The 2015 survey was conducted at the Health University of Applied Sciences Tyrol by the Department of Dietetics in cooperation with the Department of Nutritional Sciences of the University of Vienna [10]. The Survey looked at health and environmental indicators to not only investigate the question on how healthy dietary choices in Tyrol are, but also on how they contribute to the environment and thus to climate change.

METHODS

STUDY POPULATION

The Tyrolean Nutrition Survey 2015 had a cross-sectional design and included data on eating and exercise habits, anthropometric measurements and body composition analysis of 463 adults (aged 18–64 years) living in the NUTS-3 region of Innsbruck, Tyrol. The data provided by Statistics Austria [11] are based on the register of residents and were stratified by sex and age by dividing the population into the age groups of 18–24, 25–50 and 51–64 years. Data assessment took place from July 2014 until November 2015. In order to obtain representative results for this region, a minimum net sample of 400 individuals was required with a significance level of ± 5 % (P<0.05), within a confidence interval of 95 % for a population of 193 386 individuals in the year of 2014.

ASSESSMENT OF DIETARY INTAKE

In the course of one year, the survey was conducted on the basis of two non-consecutive 24 h recalls, the first of which was carried out as a computer-assisted personal interview and the second as a computer-assisted telephone interview six weeks later. To obtain the most accurate information on food consumption, the computer software Globodiet® (formerly EPICSoft) was used. This software with the corresponding photo book was developed by the International Agency for Research on Cancer (IARC) and further adapted for Austria by the Department of Nutritional Sciences at the University of Vienna. The participants were asked in detail about the type and quantity of foods consumed in a past 24 h period. The reported foods were linked to the German food composition database Bundeslebensmittelschlüssel (BLS) version 3.02 [12] and the Austrian Food Database Österreichische Nährwerttabelle (ÖNWT) [13]. For further evaluation, food items assessed by the 24 h recalls were categorized into food groups. Those food groups were defined by the similarity of food items regarding their nutrient profile (e.g. carbohydrates, dietary fibre, fats, protein) and their affiliation to common main food groups (e.g. milk and milk products, grains, vegetables) based on the classification of the BLS and the ÖNWT. Concurrently, the mass (in grams) of food items consumed was combined into appropriate food groups.

CALCULATION OF $KGCO_{2E}$

For the carbon footprint the amount of consumed foods in grams were linked with $kgCO_{2e}$ using secondary data from Life Cycle Assessments (LCA) [14] to calculate $kgCO_{2e}$ for each food group. In order to facilitate the comparison of the results, the values were standardized to an energy intake of 2000 kcal, which represents an average intake for adult men and women. The average $kgCO_{2e}$ and the nutrient intake of the study population were calculated and compared using variance analysis and t-test, whereas all p-values presented are two-tailed; $P<0·05$ was considered significant.

EVALUATION/RESULTS

Table 1 shows the absolute intake levels and the $kgCO_{2e}$/d for each food group. Meat consumption among the Tyrolean population is 26 % above the recommendations [15] with 82.8 g/day, accounting for 0.88 $kgCO_{2e}$/d. Men consume significantly more meat and meat products, showing in higher CO_{2e}/d with 0.98 kg compared to women with 0.74 $kgCO_{2e}$/d ($p \leq 0.001$). The amount of consumed milk and milk products represents 1.5 portions and is lower than the recommended amount of 3 portions per day [15]. However, it comprises 21.3 % of the daily $kgCO_{2e}$. Together, meat and milk products account for 42.3 % of $kgCO_{2e}$/d in Tyrol.

Table 1. Absolute intake of food groups in grams per day and respective mean $kgCO_{2e}$ per day

food groups	mean intake in g/d	mean $kgCO_{2e}$/d	%
Non-alcoholic drinks	1899.10	0.36	8.66
Coffee and tea	615.00	0.25	5.86
Vegetables and legumes	184.27	0.15	3.57
Fruits	140.31	0.12	2.77
Bread	111.82	0.17	4.00
Grains	140.51	0.33	7.91
Potatoes	47.26	0.03	0.68
Milk, milkproducts and cheese	219.53	0.90	21.30
Vegetables oils, nuts and seeds	16.30	0.03	0.65
Butter	8.46	0.12	2.96
Eggs	16.43	0.04	1.02
Meat and meat products	82.83	0.88	20.96
Fish and seafood	28.83	0.16	3.91
Sweets, cakes and snacks	103.80	0.21	5.01
Fast food	7.23	0.03	0.74
Alcoholic beverages	178.18	0.12	2.97
Soy products	7.67	0.01	0.22
Others	123.59	0.29	6.81
Total	**3989.56**	**4.20**	**100.00**

Table 2 shows the characteristics of the study population and respective $kgCO_{2e}$. When comparing men and women, men have significantly higher absolute $kgCO_{2e}$-values than women, but there are no significant differences when looking at $kgCO_{2e}$-density (standardized at 2000 kcal). Omnivores have significantly higher absolute $kgCO_{2e}$/d and higher values of $kgCO_{2e}$-density compared to vegetarians and vegans.

Table 2. Characteristics of the study population and according kgCO$_{2e}$/d and kgCO$_{2e}$ density/d

Characteristics of study population		kgCO$_{2e}$/d		kgCO$_{2e}$ density/d*	
Sex	Female (n = 235)	3.6 ± 1,1		4.1 ± 1.3	
	Male (n = 228)	4.9 ± 1.7		4.0 ± 1.1	
	p-values	***<0.001***		*0.362*	
Age groups, *years*	18 – 24 (n=75)	4.6 ± 2.1		4.0 ± 1.1	
	25 – 50 (n = 269)	4.2 ± 1.5		4.1 ± 1.2	
	51 – 64 (n = 119)	3.9 ± 1.2		4.0 ± 1.2	
	p-values	***0.007***		*0.626*	
BMI, *kg/m^2**	< 18.5 (n = 16)	3.7 ± 1.0		3.4 ± 0.9	
	18.5 – 24.9 (n = 275)	4.2 ± 1.5		3.9 ± 1.1	
	25 – 29.9 (n = 127)	4.4 ± 1.7		4.4 ± 1.2	
	> 30 (n= 45)	4.2 ± 1.58		4.0 ± 1.4	
	p-values	*0.341*		***<0.001***	
Smoking	Yes (n = 111)	4.3 ± 1.8		4.0 ± 1.2	
	No (n = 347)	4.2 ± 1.5		4.1 ± 1.2	
	p-values	*0.181*		*0.431*	
			*p-values***		*p-values***
Diet	Omnivore (n = 442)	4.3 ± 1.6		4.1 ± 1.2	
	Vegetarian (n = 13)	3.3 ± 1.0	***<0.001***	3.0 ± 0.5	***<0.001***
	Vegan (n = 8)	2.7 ± 1.0	***<0.001***	2.7 ± 1.0	***<0.001***
	Vegetarian & vegan (n=21)	3.0 ± 1.0	***<0.001***	2.9 ± 0.7	***<0.001***

values are means ± standard deviation (SD)
* standardized to an energy intake of 2000 kcal
** group differences compared with with omnivores
P values differences are based on t-tests or ANOVA

CONCLUSION

With 4.2 kg CO$_{2e}$/d or 1.6 t per year and person, Tyrol is in the lower average compared to Austria with 2.5 t per year [14]. Although the study population only consumed half of the recommended amount of milk and milk products, 21.3 % of total kgCO$_{2e}$/d comes from this food group since it accounts for a proportionally high amount of kgCO$_{2e}$/d. As in many other countries and regions, also in Tyrol meat consumption is too high [15]. Still, compared to the Austrian food-based dietary guidelines (FBDGs – Austrian Food Pyramid) the average kgCO$_{2e}$/d are lower (4.04 kg vs. 4.74 kg per 2000 kcal) due to the recommendation of 3 portions milk and dairy. To achieve a diet that is both healthy and sustainable, the intake of animal-derived foods needs to be reduced in exchange of regional plant-based protein-sources such as pulses, nuts, seeds and grains [4, 5]. Also, an update of the Austrian FBDGs, aligned with international evidence and recommendations regarding healthy and sustainable nutrition [5], is recommended. Currently, the Tyrolean Nutrition Survey 2021 takes place. The aim is to assess dietary intake and its impact on health and the environment even further to see trends and developments since the last survey and to identify, which targeted public health measures need to be implemented.

ACKNOWLEDGEMENT

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