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Community supported agriculture's perceived positive impacts on mental health and vegetable consumption in Norway and the UK

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Abstract

Community supported agriculture (CSA) is a format for provisioning food, usually vegetables, where consumers are involved, to various degrees, in the production process. In this study of survey data, we explore differences between CSAs in Norway and the UK in terms of organisational models and member characteristics, particularly the factors that contribute to increase member contentment with CSAs, and their perceptions of their own mental health and vegetable consumption. Results show that compared to the British, Norwegian CSA members participate far more actively in the cultivation and harvesting of the vegetables, and more often prepay subscriptions for the whole season. In both countries, CSA membership was perceived to have caused improvements in members' life quality, vegetable intake and physical and mental health. Members who participated more actively in the CSA and who received more of their vegetables through the CSA, were also more satisfied with their CSA and had a stronger perception that their vegetable consumption level and their mental health were positively affected by membership. Members with lower educational attainment levels were more likely to have discovered new vegetables through the CSA. Environmentally friendly production methods were also found to be important for CSA members. Vegetable quality and affordability were associated with higher contentment, and learning how to cook and grow vegetables through the CSA was associated with higher consumption of, and interest in, new vegetables. Overall, the results indicate that CSAs can stimulate contentment due to their members' perceptions of social and environmental benefits.

Keywords: Local food systems, Short food supply chains, Sustainable diets, Healthy diets, Sustainable food transition, Regression analysis

Introduction

Dominant global food systems are associated with various forms of environmental degradation. For example, agro-industrial, monoculture production contributes to soil degradation and use of agrochemicals and long-distance transport cause pollution of soil, water and air (Leclere et al. 2020). The situation is aggravated by growing

global consumer demand for animal-based food, which increases greenhouse gas emissions and the need for agricultural land, as well as posing diet-related public health risks (Poore and Nemecek 2018; Willett et al. 2019). In addition, there is also concern that, in Western Countries, social relationships, which are important to public health, are weakening due to individualism, urbanisation, reliance on technologies, disconnection from the natural environment and lack of trust (Veen et al. 2016).

To overcome these impacts, calls have emerged for a transformation of the food system through more environmentally friendly, agroecological production methods and a dietary change towards more plant-based food (Billen et al. 2021; Crippa et al. 2021; Hertel et al. 2021; Willett et al. 2019). Furthermore, studies suggest that short food supply chains (SFSC) for local food can contribute to sustainability and resilience goals, for instance by increasing access to fresh and healthy food and improving social relationships and solidarity between producers and consumers (Medici et al. 2023; Milford and Reed 2024; Petruzzelli et al. 2023).

Community supported agriculture (CSA) is a format of SFSC production that has received much attention over recent years, and found to have potential to provide a range of environmental as well as social benefits (Diekmann and Theuvsen 2019; Hvitsand 2016; Schrank and Running 2018; Sulistyowati et al. 2023). This includes a positive impact on members' diets (Berkowitz et al. 2019; Cohen et al. 2012; Gaddis et al. 2020) and mental health (Birtalan et al. 2020; Zepeda et al. 2013). However, while previous studies have identified a link between CSA membership and improvements in diets and mental health, there is a lack of research-based knowledge on which specific attributes of CSAs stimulate these positive associations. Vegetable consumption and mental health are important potential outcomes of CSA memberships, since a transition towards healthy, plant-based diets is crucial for both environmental and public health reasons, and good mental health is a fundamental societal benefit. Furthermore, as CSA membership seems time-limited (Galt et al. 2019; Witzling et al. 2020), there is also need to understand factors that secure members' contentment, which is likely to increase member retention.

A longitudinal study by Enthoven and Van den Broeck (2021) that included CSAs revealed a high degree of context dependency in gauging the success of local food initiatives to lever change. A key conclusion was the need to be more precise about the benefits of different formats of local food, especially as understandings, concepts and presumptions vary between countries. The authors indicated a lack of "cross-country comparable data hindering the possibility of drawing generalisable conclusions on the benefits" of local food systems (Enthoven and Van den Broeck 2021). For instance, econometric analyses of survey data with CSA members in several countries are scarce.

Our contribution, correspondingly, presents a binational comparison of CSAs, following regression and correlation analyses of CSA consumer surveys carried out in 2022. The aim of the study is to investigate, firstly, the organisational differences between CSAs in Norway and the UK; secondly, which factors influence member contentment with CSAs; and, finally, which factors influence the members' perception regarding the CSAs' effect on their mental health and vegetable consumption habits in terms of quantity and types of vegetables.

The reason for selecting Norway and the UK is because they were paired as part of the project "UrbanFarms", financed by the Norwegian Research Council. The project's aim was to understand how professional farmers in, and close to cities, could optimise the advantages of the urban market to add value to sustainably produced food. In the project, Bristol was selected as a location of interest for comparison with Bergen and Oslo, due to its experience of local and SFSC innovation and urban sustainable food policy-making (for example see Carey (2013); Koopmans et al. (2017); Morgan (2015)). Interest in CSAs as a specific organisational form of peri-urban agriculture emerged as part of the project's focus on consumer sales channels.

The article proceeds as follows: the following section outlines the multiple health, social and environmental benefits associated with CSAs as indicated in recent critical studies, and offers a short description of the history of CSAs in Norway and the UK. In Sect. "Methods", the study's survey methodology is described, followed by the presentation of key results, in Sect. "Results". The discussion, Sect. "Discussion", highlights the implications of the econometric analysis on the research questions. This section also makes use of the free-text qualitative comments offered in the survey returns to add context to the statistical analyses. Finally, some concluding recommendations are made.

CSA characteristics

Literature review: CSAs as multifunctional provisioning models

Community supported agriculture (CSA) remains an enduring format of food provisioning in many parts of Europe and conforms largely to the four characteristics linked to alternative food networks (AFNs) offered by Jarosz (2008). These are: (i) short distances between producers and consumers; (ii) small farm sizes operating some form of environmentally motivated production; (iii) food purchasing arrangements which offer direct and transparent connection between consumers and producers; and (iv) the presence of food purchasing venues such as farmers markets, farm shops or, more likely for CSAs, pick-up locations.

Within CSAs, food is produced in long-term collaboration between producers and consumers, involving shared responsibilities, risk and harvest between the parties (Hvitsand 2016). Consumers are, to a varying degree, involved in cultivation and administrative processes: some CSAs are consumer-led and formed and managed by a core group of members, while others are producer-led, which means that a farmer maintains ownership of the operation and members subscribe to the harvest (Espelt 2020).

Motivations for CSA membership are varied. Transparency is important for consumers who are concerned about ethical aspects of food production, including environmental impact (Diekmann and Theuvsen 2019; Hvitsand 2016; Schrank and Running 2018; Sulistyowati et al. 2023). Community ties may arise within the enterprise as well as between farmers and their customers, captured by discussions of the social capital that this form of exchange generates (Atakan and Yercan 2021; Galt et al. 2019; Plank et al. 2020; Sulistyowati et al. 2023). In addition to the attraction of such ethical or social attributes, consumers are motivated to join CSAs to buy high quality and healthy food (Brehm and Eisenhauer 2008).

Studies associate CSAs with a range of benefits, including innovative business models (Keech et al. 2023), the creation of trust (Zoll et al. 2023) and their contribution to

food supply resilience, especially during the COVID-19 pandemic (Jones et al. 2022). Environmental benefits are derived for instance from CSAs' use of organic production methods (Fomina et al. 2022; Medici et al. 2021), resource use efficiency (Egli et al. 2023) and their propensity to reduce food waste (Baker et al. 2019). CSAs have also been found to contribute to several aspects of human well-being (Birtalan et al. 2020) including psychological (Zepeda et al. 2013) and health benefits due to an increase in the consumption of vegetables (Cohen et al. 2012; Mills et al. 2021). CSAs can broaden the profile of food consumption, if members embrace new types of seasonal vegetables, rather than being selective as a result of their habitual food purchasing patterns (Wilkins et al. 2015). In their study from the UK, Bellamy et al. (2023) found that 90% of members reported receiving vegetables from their CSA that they normally would not buy or eat, and that they would eat these to avoid food waste. They also attributed increased value to vegetables that were produced on their behalf or in partnership with other members. A healthier diet with more vegetables can in itself also explain CSAs' positive effect on members' mental health (Brennstuhl et al. 2021; Glabska et al. 2020), while this effect can also be caused by increased social interaction with other members or a more holistic connection to food involving stronger relationships with nature and food production (Birtalan et al. 2020).

Some characteristics of CSAs cause ambivalence, which may cause members to leave (Witzling et al. 2020). CSA membership may demand physical work (Plank et al. 2020), and the risk sharing model requires members to make a prepayment for the food. Particularly for low-income consumers, this can be a barrier to membership (Parot et al. 2023; Plank et al. 2020). Furthermore, CSA members usually do not know beforehand how much or which types of vegetables they will receive, which some members may dislike (Galt et al. 2019; Zepeda et al. 2013).

Demographically, CSA members typically enjoy higher incomes (Egli et al. 2023; Mills et al. 2021; Vassalos et al. 2017), are younger (Gugerell et al. 2021; Vassalos et al. 2017) and more educated (Galt et al. 2019; Vassalos et al. 2017) than the average consumer. They are also more likely to be female (Cohen et al. 2012; Gugerell et al. 2021).

Background: the development of CSAs in Norway and the UK

In the UK in 2008, the Soil Association, in collaboration with a consortium of civil society organisations, started the project "Making Local Food Work". Within this, the Soil Association promoted CSAs as a practical innovation to support local food chains, offering tools such as harvest planners, networking opportunities and written guidance on securing land. CSAs were temporarily championed by the National Federation of City Farms and Community Gardens, before the current CSA-UK network was established. Outside such AFN framings, a small number of CSAs had already been established in the UK in the 1990s, drawing inspiration from the CSA movement in the USA led by Trauger Groh and Robyn van En (Henderson and Van En 2007). Grounded in communitarian philosophies (cf. Pepper 1993), these CSAs found space and operational support within the Camphill School organisation, linked to Rudolf Steiner philosophies. At the time of writing, there were around 147 CSAs in the UK (CSA Network UK 2024).

In Norway, the first CSA, Øverland andelslandbruk, started in 2006 at the initiative of the foundation Norges Vel, which organised a project promoting CSAs in 2003 (Bjune

and Torjusen 2005; Devik 2013). The initiators were inspired by experiences of CSAs from other countries, and a main motivation in Norway was to increase provision of organically produced food and using peri-urban land for food production (Bjune and Torjusen 2005). After establishment, the Øverland CSA collaborated with the organisation Organic Norway in promoting CSAs in other parts of the country (Devik 2013), and in 2022 there were approximately 90 active CSAs in Norway (Milford and Devik 2023).

Methods

Data collection

This study was conducted in collaboration with the Norwegian network for CSAs, coordinated by Organic Norway. In the UK in 2022, the CSA Network UK was preparing to carry out a survey of its constituent CSAs and agreed to synchronise with the authors to extend their survey.

A questionnaire for a quantitative survey of CSA members was developed by researchers in collaboration with representatives from the CSA Network UK and Organic Norway. The questionnaire was divided into four sections to stimulate data on:

- Characteristics of CSA membership
- Perceived benefits and drawbacks with CSA membership
- Consumer demographics
- Food attitudes

The questionnaire was tested with three Norwegian and two British CSAs, and some adjustments were made subsequently. A link to the electronic questionnaire was sent to all CSA administrators in the UK and Norwegian networks, with a request to distribute the survey link to their members via social media platforms, e-mail or other routine correspondence methods. The collaboration with the two national CSA networks allowed the research team to reach members without the need for direct personal contact. Participation in the survey was incentivised by randomly selecting four respondents to receive a gift voucher. The survey ran March–April 2022. Data collection and storage methods were compliant with ethical and legal privacy regulations as described by the Norwegian Agency for Shared Services in Education and Research (Sikt) and were also assessed and approved by the internal ethics committee of the Countryside and Community Research Institute (CCRI).

A total of 362 Norwegian returns were received (271 complete) and 213 from the UK (167 complete). As some questions in the survey were optional/context dependent, not all respondents answered all the questions in the questionnaire, hence the number of observations vary for the different questions. Returns were received from members of 45 different Norwegian CSAs and 26 in the UK. The locations of the CSAs that answered the survey are shown in Fig. 1.

Data analysis

The data gathered from Norway were presented as tables and figures in a report published in Norwegian (Milford and Devik 2023). A selection of these results was made for further analysis and comparison with the UK data returns. Tables and figures were

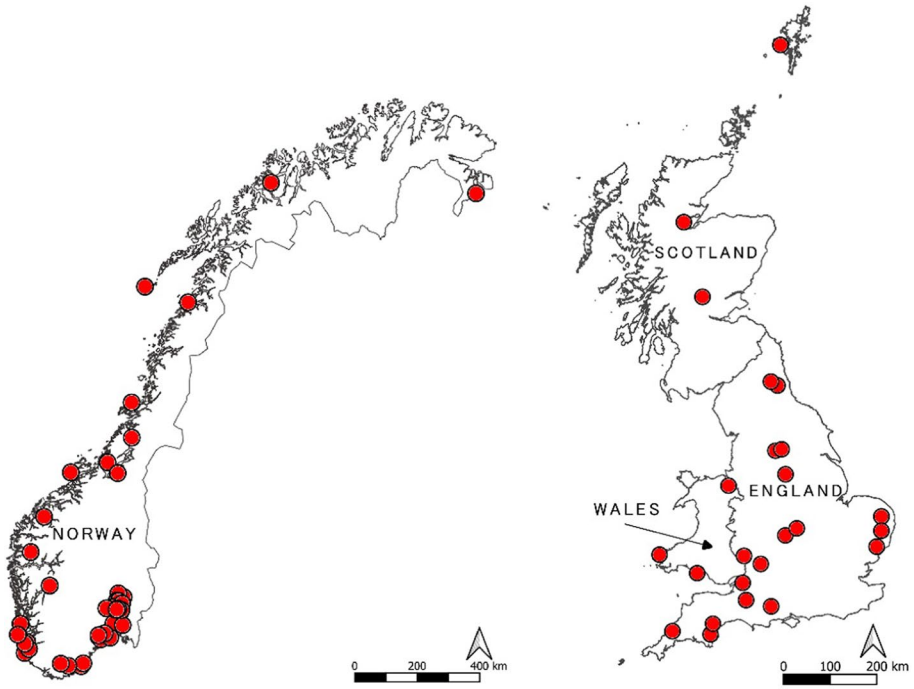

Fig. 1 Maps showing the CSAs that responded to the survey. UK boundary sourced from Ordnance Survey Boundary-Line® under Open Government Licence v3.0. Norway boundary sourced from GeoBoundaries licensed Under Creative Commons Attribution 4.0 International (CC BY 4.0)

created with Stata 18 and Excel to compare Norway and UK in terms of qualities of CSAs and perceived benefits and drawback with CSA membership. To identify factors influencing members' contentment with their CSA and perceived impact on vegetable consumption and mental health, we performed pairwise correlation analyses and regression analyses with four different dependent variables.

The measure for contentment with CSA was the answer to the question "How satisfied are you with your CSA on a scale of 1–7, where 1 is not satisfied at all and 7 is very satisfied?". As less than 3% of the respondents gave a score of 4 or lower, the variable was transformed into an ordinal variable in the range 1–4, where 1 is answers from 1 to 4, 2 = 5, 3 = 6 and 4 = 7. To measure the perceived impact of the CSA on vegetable consumption, we used the question "To what extent do you think the following are benefits which you get from being part of a CSA, as opposed to buying from a supermarket?", with the answers to the alternatives "It encourages me/my family to eat more vegetables" and "I have discovered vegetables I didn't know/eat before". The answer categories went from 1 = No benefit, to 5 = Large benefit. The variable used for measuring perceived improvement to mental health was the question "do you feel that your involvement in the CSA has led to any of the following…" and the alternative "improved your mental health" (see Table 5). The alternative answers were "Yes", "No" and "I don't know/not sure". As the wording used in the English and Norwegian versions of the question was slightly different, with the English question being asked more cautiously ("Do you feel that your involvement with your CSA has…") and the Norwegian more directly ("Has your membership in the CSA led to…"), it is possible

that Norwegians were more likely to answer "don't know/not sure". For the statistical analysis "don't know"—answers were merged with "yes" answers to eliminate some of this bias.

These four variables were used in a regression analysis where 12 factors were included as independent variables to estimate if they had any effect on CSA contentment and vegetable consumption habits. The variables are described in Table 7. The variables can be classified as:

1. Variables describing the respondents' involvement with the CSA, e.g. length of membership, participation in voluntary labour, regularity of visits to the CSA, the amount of vegetables received, if the CSA was offering recipes or courses/training; and
2. Other characteristics of the respondents: age, gender, income, education and environmental awareness in relation to food purchases.

We used an ordered probit model for the regressions with rating of the CSA and the perceived changes to dietary habits as dependent variables. The ordered probit model can be represented as

$$y^* = x\beta + \varepsilon \tag{1}$$

where y^* is a latent dependent variable, x is a vector of the independent variables, β is a vector of the associated coefficients and ε is the error term assumed to be normally distributed. The associated probabilities of the responses can be represented as

$$\begin{aligned} &P(y=1|x) = P(y^* \le \omega_j|x) = \Phi(\omega_1 - x\beta) \\ &P(y=2|x) = P(\omega_1 < y^* \le \omega_2|x) = \Phi(\omega_2 - x\beta) - \Phi(\omega_1 - x\beta) \\ &\vdots \\ &P(y=J|x) = P(y^* > \omega_j|x) = 1 - \Phi(\omega_j - x\beta) \end{aligned} \tag{2}$$

where y is the response choices ranging from $y = 1, 2, 3...., J$, ω is the category threshold parameter or cut-off point ranging from $\omega = 1, 2...., J-1$ and Φ is the standard normal distribution function (Wooldridge 2010).

For the regression with perceived change to mental health as dependent variable, the probit model was used. The probit model is a special form of the ordered probit. When $y = 1, 2$, the ordered probit turns to a probit model (Wooldridge 2010). Both the probit and ordered probit model are estimated using maximum likelihood estimation (Hilbe 2014; Wooldridge 2010). The regression analysis was performed in Stata 18 with aggregated data from both countries. The number of observations for Norway was 240, and 160 for UK. Given that we had 12 predictor variables it was considered most prudent to run the regression analysis with the aggregated data set, which gave 33 respondents per predictor variables (VanVoorhis and Morgan 2007). When doing so, we used country (Norway) as a dummy variable to control for country differences.

To complement our regression analyses, we conducted pairwise correlation analyses with factors that measure perceived benefits from being part of a CSA (see Table 3). We avoided including these factors in the regression as we considered them to be normative and they could easily introduce subjectivity bias.

Results

We first present descriptive statistical results comparing CSAs and CSA membership in Norway and the UK, which give insights into the different organisational models used for vegetable delivery, and to what extent members are involved actively with their CSA. This is followed by a presentation of descriptive statistical results showing perceived benefits and drawbacks of CSA membership in the two countries. Lastly, results are shown of the pairwise correlation and regression analyses of factors influencing member satisfaction with their CSA, consumption of vegetables and mental health.

Organisational structure

There are significant differences between Norway and the UK regarding how CSA members receive their share of vegetables and how actively they participate in the CSA, as shown in Table 1, which also includes a Chi-square test of difference in results between the two countries (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). In Norway 87% of the CSA members harvest produce themselves, while only 5% of the British CSA members do the same. In the UK, most members (40%) collect their produce from the CSA once the vegetables have been harvested. In this case, vegetables are not distributed into boxes or bags, instead the members package their own vegetables. It is also common in the UK to collect vegetables ready-packaged at the CSA or at a pick-up point, or to get them home-delivered. Furthermore, in Norway 87% participate in growing the vegetables, against 42% in the UK. Norwegian members also visit the site more regularly (84% against 66% in the UK). However, members in Norway and the UK participate almost to the same extent in CSA events and social activities (61 and 60%).

Another significant difference found between the two countries is in the payment system. In Norway, most members pay in advance for the entire season (97%), whereas in the UK most members (73%) pay for one month at the time, and only 9% for the whole season.

Respondents were also asked to rate the importance of different CSA services, see Table 2. Results from Norway and the UK are similar, but social media groups and training and courses are more common and valued in Norway than in the UK. Social gatherings at the farm are slightly more common in the UK than in Norway.

Table 1 Interaction with CSA through vegetable deliveries, participation and farm visits

	Norway (%)	UK (%)	Chi2 difference test
Harvest myself at CSA	87	5	***
Collect ready harvested and package myself at CSA	5	40	***
Collect from CSA ready packed	1	14	***
Collect from other pick-up point	4	25	***
Delivered to my house by the CSA	0	12	***
Other type of delivery model	2	3	
Volunteer (growing)	87	42	***
Attend CSA events and social activities	61	60	
Regular visitor to site	84	66	***

Answers to question: "How do you receive your CSA share?"(Norway: N = 379 and UK: N = 218) and "Do you have any involvement with the CSA beyond receiving produce?" (Norway: N = 324 and UK: N = 195)

Table 2 Rating of CSA services

		Yes, and I appreciate it (%)	Yes, but it's not important to me (%)	I don't know (%)	No (%)	Chi2 difference test
Group on social media (Facebook, WhatsApp, etc.)	Norway	69	22	7	3	***
	UK	36	32	26	6	
Social gatherings at the farm	Norway	68	19	8	5	**
	UK	73	23	4	1	
Recipes on how to use the vegetables, provided on paper	Norway	11	6	26	58	***
	UK	19	18	15	49	
Recipes provided via e-mail or social media	Norway	48	16	18	18	
	UK	44	20	16	20	
Camping facilities	Norway	2	4	22	72	*
	UK	7	5	23	65	
Possibility to use grounds for parties, etc.	Norway	16	8	39	37	
	UK	14	7	45	34	
Training or courses	Norway	40	11	23	26	***
	UK	28	21	29	22	

Answer to question: "Does your CSA have any of the following…" (UK: N = 199, Norway: N = 341)

Benefits and drawbacks

Respondents offered their perception of benefits of CSA membership, compared to buying from a supermarket, rating each alternative presented from 1 to 5, where 1 is "no benefit at all" and 5 is "huge benefit". "I don't know" answers were deleted, and the number of observations therefore varies for each of the variables, between 255 and 331 for Norway, and between 161 and 194 for the UK.

Table 3 shows the rating of benefits, and how they are ranked according to average rating (from highest to lowest) as a total mean and for each of the two countries. A t-test for mean difference of the ratings from the two countries was also executed.

Most of the potential benefits receive a high average rating (between 4 and 5). In both countries, "the vegetables are sustainably produced" received the highest average rate. "Less food packaging" received a high rate in both countries, but "the vegetables are safe and healthy" and "I/my family learn about growing food" was rated higher in Norway than in the UK.. Affordable vegetables are perceived as more of a benefit of the CSA for the British than for the Norwegians, while the Norwegians perceive more benefits from receiving information about how to cook vegetables. In both countries, these two questions received the lowest rating.

In the same manner, respondents were asked to rate potential drawbacks of CSA membership, ranging from 1 ("no drawback") to 5 ("large drawback"). Those who answered 6 ("not relevant") were not included, which means that the number of respondents varies for each question. Results are shown in Table 4, including t-test results for mean difference of the ratings from the two countries.

In general, perceived potential drawbacks receive a low average score (the highest is 2.1). In both countries, "higher prices" and "the vegetables are sometimes damaged by pests" received higher rates, but in the UK "I sometimes get vegetables I don't want" was the most important drawback. In Norway "it takes longer to fetch the vegetables"

Table 3 Rating and ranking of perceived CSA benefits

	Total mean		Norway		UK		Mean difference t-test
	Rate	Rank	Rate	Rank	Rate	Rank	
The vegetables are sustainably produced	4.83	1	4.82	1	4.84	1	
There is less food packaging	4.72	2	4.69	3	4.77	2	
The vegetables are safe and healthy	4.7	3	4.79	2	4.53	6	***
Reduced food miles	4.64	4	4.56	5	4.77	3	**
I am supporting local producers	4.63	5	4.57	4	4.73	4	***
I eat more seasonally	4.54	6	4.53	7	4.57	5	
The vegetables are high quality	4.49	7	4.54	6	4.41	7	
It encourages me/my family to eat more vegetables	4.41	8	4.53	8	4.21	9	***
I know the farmer who produce the food I eat	4.35	9	4.36	10	4.32	8	
I/my family learn about growing food	4.2	10	4.5	9	3.66	13	***
I/my family can spend time on the farm	4.13	11	4.32	12	3.79	11	***
I have discovered vegetables I didn't know/eat before	4.1	12	4.34	11	3.69	12	***
I'm more involved in local community	4.03	13	4.04	13	4.03	10	
I get information about how to cook vegetables	3.46	14	3.8	14	2.86	15	***
The vegetables are affordable	3.4	15	3.28	15	3.57	14	**

Answer to question: "To what extent do you think the following are benefits which you get from being part of a CSA, as opposed to buying from a supermarket?" 1 = No benefit to 5 = Large benefit

Table 4 Rating and ranking of perceived CSA drawbacks

	Total mean		Norway		UK		Mean difference t-test
	Rate	Rank	Rate	Rank	Rate	Rank	
Higher prices	2.1	1	2.1	1	2.1	2	
The vegetables are sometimes damaged by pests	2.0	2	2.0	2	2.0	3	
I sometimes get vegetables I don't want	1.9	3	1.6	6	2.4	1	***
It takes longer to fetch the vegetables	1.9	4	2.0	3	1.7	6	**
I can't choose when I get my vegetables	1.8	5	1.7	4	1.9	4	
I get too many vegetables and don't manage to eat them all	1.7	6	1.7	5	1.7	7	
The vegetables need to be cleaned	1.6	7	1.6	7	1.8	5	
I don't feel I'm part of the community like the other CSA members	1.4	8	1.4	8	1.5	8	
The payment system is inconvenient for me	1.2	9	1.1	10	1.2	10	
The vegetables sometimes have odd shapes	1.2	10	1.1	11	1.3	9	**
I don't like the farmer	1.1	11	1.2	9	1.1	11	*

Answer to question: "To what extent do you think the following are drawbacks from being part of a CSA, as opposed to buying from a supermarket?" 1 = No drawback to 5 = Large drawback

is rated higher than in the UK, which corresponds with the difference in organisational models. Otherwise, results are similar for the two countries. "The vegetables sometimes have odd shapes", "I don't like the farmer" and "the payment system is inconvenient for me" are the lowest rated drawbacks for both countries.

Respondents were asked "Do you feel that your involvement with your CSA has…" and then presented with a range of alternatives, as set out in Table 5, along with the answers. A large majority believe their CSA has improved their quality of life and cooking and

Table 5 Perceived improvements caused by involvement with CSA

Variable		Yes (%)	No (%)	Don't know/ not sure (%)	Chi2 difference test
Improved quality of life	Norway	79	4	17	
	UK	82	5	13	
Improved your cooking or eating habits	Norway	71	11	18	***
	UK	80	15	5	
Improved your physical health	Norway	36	29	36	***
	UK	55	25	20	
Improved your mental health	Norway	56	18	26	***
	UK	64	18	19	
Increased your skills	Norway	76	9	15	***
	UK	54	37	9	
Increased your social network/built new friendship	Norway	55	26	19	
	UK	63	30	8	

Answer to question "Do you feel that your involvement with your CSA has…" (UK: N = 196, Norway = 321)

eating habits. The latter corresponds to the findings of Table 3, which shows that many believe CSA membership encourages them to eat more vegetables. Results are similar for both countries, but the Chi-square test shows that significantly more people in Norway believe their CSA has increased their skills, and more people in the UK believe their CSA has improved their eating habits and physical and mental health.

Factors influencing contentment and perceived improvement of mental health and diets

To identify associations between CSA qualities and member characteristics and contentment with membership and perceived changes in diets and mental health, we performed pairwise correlation and regression analyses, as described in the methodology section.

Correlations were checked between rating of CSAs, perceived impact of CSA on mental health and consumption of vegetables including vegetables not previously eaten, and the variables for the different benefits of the CSA (shown in Table 3).

Results show, as expected, that most of the variables measuring perceived benefits are positively correlated with rating of the CSA. The three highest correlation values for each column in Table 6 are shown in bold. "I/my family can spend time on the farm" has a strong correlation with CSA rating and perceived improvement of mental health and diets for both countries. Other factors that stand out as being particularly impactful are: the vegetables are high quality, getting information about how to cook vegetables, learning about growing food and becoming more involved in the local community.

For Norway, "the vegetables are affordable" is the variable most strongly correlated with CSA rating and it is also strongly correlated with having discovered new vegetables. In the UK, "I know the farmer who produces the food I eat" is strongly correlated with CSA rating, but also with perceived improvements to mental health and diets, while this is not the case for Norway.

We also performed a regression analysis with different variables compared to those used in the correlation analysis. Table 7 describes the variables included and shows

Table 6 Pairwise correlation rating CSA, perceived improvement of mental health and diets ("Don't know" answers deleted) (UK: N = 183; Norway: N = 272)

Variables	UK				Norway			
	Rate CSA	Mental health	More veg	New veg	Rate CSA	Mental health	More veg	New veg
Rating of CSA ("Rate CSA")	1.00				1.00			
Perceived improvement mental health ("Mental health")	0.31*	1.00			0.22*	1.00		
It encourages me/my family to eat more vegetables ("More veg")	0.27*	0.18	1.00		0.17*	**0.22***	1.00	
I have discovered vegetables I didn't know/eat before ("New veg")	0.33*	0.19	0.43*	1.00	0.16*	0.20*	0.37*	1.00
The vegetables are high quality	**0.38***	0.14	0.30*	0.29*	**0.26***	0.11	0.24*	0.19*
The vegetables are sustainably produced	0.14	0.02	0.24*	0.06	0.11	0.15	0.23*	0.04
The vegetables are safe and healthy	0.13	−0.01	0.34*	0.27*	0.15	0.18*	0.23*	0.13
I am supporting local producers	0.27*	−0.06	0.31*	0.14	0.13	−0.02	0.18*	0.15
I know the farmer who produce the food I eat	**0.36***	**0.30***	0.27*	0.34*	0.14	0.14	0.15	0.11
I get information about how to cook vegetables	**0.34***	0.23*	**0.38***	**0.55***	0.20*	0.19*	**0.38***	**0.50***
I/my family learn about growing food	0.29*	**0.35***	**0.43***	**0.42***	0.14	**0.24***	0.24*	**0.26***
The vegetables are affordable	0.32*	0.14	0.33*	0.36*	**0.27***	0.15	0.18*	**0.20***
There is less food packaging	0.11	0.00	**0.38***	0.20*	0.10	0.07	0.11	0.08
Reduced food miles	0.11	−0.05	0.27*	0.23*	-0.02	0.09	0.12	0.08
I eat more seasonally	0.20*	0.13	0.36*	0.35*	0.19*	0.06	**0.34***	**0.20***

Table 6 (continued)

Variables	UK				Norway			
	Rate CSA	Mental health	More veg	New veg	Rate CSA	Mental health	More veg	New veg
I'm more involved in local community	0.21*	0.07	0.22*	0.24*	0.24*	0.20*	0.07	0.14
I/my family can spend time on the farm	0.33*	**0.35***	0.30*	**0.43***	**0.27***	**0.25***	**0.25***	0.17*

* Shows significance at $p < 0.01$

the total mean, the mean for each country separately and the results of a mean comparison t-test between the two countries.

The mean comparison test shows that the British has on average been CSA members for longer than the Norwegians and, when buying food, environmental factors constitute a more important value for British members than for Norwegians. We also see that Norwegians on average have a slightly higher personal income level (2.2 against 1.94), but although the difference is significant in the t-test, both Norwegian and British CSA members are on average close to 2 (£20-26K/NOK450K-600K). In Norway in 2022 the average yearly personal income level was NOK 638 000 (Statistics Norway 2024) and in the UK it was £39 000 (ONS 2023). Hence, according to this, the UK CSA members' income level is lower than the UK average, while the Norwegians are close to the country average.

The results of the regression analyses (Table 8) show that receiving a larger amount of vegetables, participation with voluntary work, getting recipes and training or courses from the CSA and having environment as an important value when food shopping are all positively associated with rating of CSA.

Receiving more vegetables from the CSA and being from Norway is positively associated with the variables measuring increased consumption of vegetables or discovering new vegetables. Having environment as a food value is positively associated with the "more vegetables"—variable. The variable for having discovered new vegetables is positively associated with participation with voluntary work and receiving training or courses and negatively associated with being male and having a higher level of education.

The perceived impact of the CSA on mental health is positively associated with receiving a larger amount of vegetables, participation with voluntary work and making regular visits to the CSA. Members who are newer, younger, have lower incomes and are from the UK are more prone to answer that their CSA has improved their mental health.

Discussion

The survey results confirm previous studies indicating that CSAs have a positive impact on members' perceptions of well-being, including life quality, physical, mental and dietary health (Medici et al. 2023; Mills et al. 2021; Zepeda et al. 2013). In addition, members' contentment with their CSA and its perceived positive impact on their mental health and diets is found to increase with active participation and

Table 7 Descriptive statistics (UK: N = 160; Norway: N = 240)

Variable name	Question	Variable description	Total mean	Mean Norway	Mean UK	Mean diff test
Rating of CSA	How satisfied are you with your CSA?	Likert scale 1–7, where 1 = not satisfied at all and 7 = very satisfied, transformed to new scale 1–4 where 1 are answers 1–4, 2 = 5, 3 = 6 and 4 = 7	3.4	3.4	3.4	
Mental health	Do you feel that your involvement with your CSA has… improved your mental health	0 = No 1 = Yes or "I don't know"	0.83	0.82	0.84	
More vegetables	To what extent is it a benefit with CSA that "It encourages me/my family to eat more vegetables" (Table 2)	1–5, 1 = No benefit to 5 = Large benefit	4.4	4.6	4.2	***
New vegetables	To what extent is it a benefit with CSA that "I have discovered vegetables I didn't know/eat before" (Table 2)	1–5, 1 = No benefit to 5 = Large benefit	4.1	4.4	3.7	***
Amount of veg	How much of your household requirements for vegetables are met by CSA produce in the weeks you receive a share?	0 = Not supplied by CSA; 1 = Less than half; 2 = About half; 3 = All or nearly all	1.5	1.4	1.5	
Voluntary work	Do you have any involvement with the CSA beyond receiving produce? How frequently do you participate?—Volunteer (growing)	0 = Not involved; 1 = Twice a month or more; or less than twice a month	0.7	0.9	0.5	***
Regular visits	How frequently do you make regular visitor to the site of the CSA?	0 = Not involved; 1 = Twice a month or more; or less than twice a month	0.8	0.9	0.7	***
Recipes	Does your CSA have recipes provided on paper or via e-mail of social media?	1 = Yes, 0 = No or I don't know	0.77	0.76	0.78	
Courses	Does your CSA have training or courses?	1 = Yes, 0 = No or I don't know	0.53	0.55	0.50	
Years as member	In which year did you first join your CSA?	1–4, where 1 = 2021–2022, 2 = 2019–2020, 3 = 2016–2018, 4 < 2016	2.7	2.5	3.0	***
Environmental concern	When shopping for food, how important is environmental impact (effects of food production and distribution on the environment) for you?	1–5 where 1 = Not important at all; 5 = Very important	4.4	4.3	4.6	***
Age	How old are you	1–7 where 1 = 24 or under, 2 = 25–34, 3 = 35–44, 4 = 45–54, 5 = 55–64, 6 = 65–74, 7 = 75 or over	4.4	4.4	4.5	
Male	What is your gender	1 = Male; 0 = Female, Other or Prefer not to say	0.2	0.2	0.2	
Education	What is your highest educational qualification?	1 = Less than secondary school; 2 = Secondary school or equivalent; 3 = College level or equivalent; 4 = Graduate degree; 5 = Postgraduate degree	4.3	4.3	4.2	
Income	What is your annual personal income (before taxation)?	1 = Less than £20K/NOK450K; 2 = £20–26K/NOK450K–600K; 3 = £26–46K/NOK600K–1000K; 4 = £46 + /NOK1000K +	2.1	2.2	1.9	**

Table 8 Results of regression analyses with CSA rating and perceived improvement of mental health and diets as dependent variables

	1 Rating of CSA	2 More vegetables	3 New vegetables	4 Mental health
Amount of vegetables	0.213*	0.329***	0.271**	0.318**
	(2.28)	(3.61)	(2.82)	(2.73)
Voluntary work	0.446**	0.121	0.348*	0.499*
	(2.82)	(0.76)	(2.39)	(2.47)
Regular visits	−0.035	−0.0430	0.075	0.432*
	(−0.21)	(−0.27)	(0.47)	(2.24)
Recipes	0.272*	0.0366	0.192	0.0668
	(2.03)	(0.26)	(1.43)	(0.36)
Courses	0.237*	0.126	0.249*	0.156
	(1.98)	(1.06)	(2.23)	(0.99)
Years as member	0.058	−0.022	0.029	−0.197**
	(0.99)	(−0.36)	(0.53)	(−2.63)
Environmental concern	0.230*	0.184*	0.114	0.147
	(2.56)	(2.16)	(1.40)	(1.32)
Age	0.018	−0.093	−0.0006	−0.143*
	(0.36)	(−1.77)	(−0.01)	(−2.18)
Male	−0.139	−0.033	−0.280*	0.233
	(−0.88)	(−0.22)	(−1.97)	(1.19)
Education	−0.03	0.094	−0.222**	0.0484
	(−0.37)	(1.15)	(−2.87)	(0.44)
Income	0.037	−0.029	0.127	−0.250*
	(0.50)	(−0.41)	(1.83)	(−2.56)
Norway	0.021	0.503***	0.590***	−0.464*
	(0.14)	(3.31)	(4.29)	(−2.37)
Constant				0.495
				(0.63)
N	400	400	400	400

Column 1–3 ordinal probit model and column 4 probit model (UK: N = 160; Norway: N = 240)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

involvement in the CSA, corroborating previous research, for example by Matzembacher and Meira (2019); Witzling et al. (2020).

We find significant organisational differences between Norwegian and British CSAs, with Norwegian CSA members participating far more actively in cultivation and harvesting. A possible explanation for this difference is higher Norwegian labour costs (Country Economy, 2019), which means that uncosted labour from members is directly financially valuable for Norwegian CSAs. Another explanation includes that Øverland, the first Norwegian CSA to adopt the self-harvesting and active member participation model, was highly active in subsequently promoting CSAs (Devik 2013). More active member involvement can explain why Norwegians express more markedly than the British a perception of having benefitted from the discovery of new vegetables. However, despite their more active involvement, the Norwegian CSA members do not rate their CSA membership benefits higher than the British. An explanation for this could be that CSAs in the UK involve members in social activities

at the farm, which might affect contentment in ways comparable with the more practical forms of involvement expressed in Norway.

Production with sustainable methods is the highest valued CSA benefit in both Norway and the UK, consistent with Hvitsand (2016); Matzembacher and Meira (2019); Schrank and Running (2018). Furthermore, the regression analysis shows that stronger environmental concern in relation to food increases contentment with the CSA. This implies that the production methods of CSAs are perceived as more environmentally friendly than conventional production, and that this aspect is important for many members. Consequently, CSAs need to prioritise sustainable production methods if they want to retain members.

Although we see that non-material factors such as environmental sustainability and active participation are associated with members' positive perception of their CSA, associations are also found between contentment with the CSA and the amount of vegetables received, as well as their quality and affordability. Hence, in line with Brehm and Eisenhauer (2008); Opitz et al. (2019) we find that the basic function of the CSA, the food itself, remains fundamental for member retention and the economic stability of the CSA.

The majority of the survey respondents believe their CSA membership has improved their eating habits, confirming results from other studies, for example those by Allen et al. (2017); Cohen et al. (2012); Mills et al. (2021); Wilkins et al. (2015). The analyses show that a range of factors are positively associated with the perception that CSA membership has led to an increase in vegetable consumption levels and the discovery of new vegetables. These include receiving more vegetables from the CSA, participating more actively in cultivation, courses and training, and receiving information about how to cook vegetables. This indicates that there are ways for CSAs to increase their positive impact on the dietary health of their members. Notably, our survey data show that people with lower educational attainment levels were more likely to state that they had discovered new vegetables through their CSA. Lower education is associated with lower intake of fruit and vegetables (see, e.g. Dehghan et al. 2011; Gebremariam et al. 2016); hence, this is a more challenging but also particularly important group to reach with different policy measures.

Our study of survey data does not provide in-depth insights to why different factors seem to have certain impacts. However, although our survey was quantitative, free text contributions were encouraged on the survey form, and some of these might shed some light on these questions:

> *"I eat more seasonal and see how much time and resources that goes into food production. Work more to reduce food waste." (Norwegian CSA member, comment to the question about whether involvement with the CSA had led to any changes).*
>
> *"Get access to vegetables I would otherwise not have bought. Fun and nice to participate in voluntary work with other members. A lot to learn about production/cultivation. Exchanging experiences/recipes with others. Healthier diets in the family" (Norwegian CSA member, comment to the question on how members appreciate their CSA).*

The quotations illustrate that active participation can inform members about the amount of work behind vegetable production, and this can become an incentive to eat all the vegetables received. Furthermore, when spending time cultivating with the other members, information about how to prepare the vegetables is sometimes exchanged.

The likelihood of answering that the CSA has improved members' mental health increases with the amount of vegetables received, indicating that the food itself might have a positive impact, supporting previous studies regarding the link between vegetable consumption and mental health (Brennstuhl et al. 2021; Glabska et al. 2020). However, the positive associations found between mental health improvement and active participation in cultivation and visits to the farm indicate, in line with Birtalan et al. (2020), that the social aspects of the CSA and the connectedness to the food production process have an important impact.

It is notable that while the demographic variables are not found to have a significant impact on CSA rating, significant associations are found for mental health. There are various possible explanations as to why CSAs are perceived to improve mental health particularly for members that are younger and have lower income. Among these are that these groups in general are struggling disproportionately with the strains of daily life than older and higher income groups. It is surprising to find that recently joined CSA members are more likely to perceive that the CSA has improved their mental health, compared to those who are established members. A possible explanation may be linked to the recent Covid-19 pandemic experience, which could have motivated new memberships during lock down. This UK comment is apposite:

> *"Without the farm through Covid, I think we would have gone mad as some of us would have had nowhere to escape to as our local parks, etc., were too full of other people needing outdoor space to feel safe because we live in the middle of a city. The open space and relaxing atmosphere are massively important for several family members mental health wise." (British CSA member, comment linked to the question about benefits from CSA).*

Among the Norwegian comments, many mention both social aspects and the joy of working with soil and cultivation as important benefits of the CSA. This respondent is indicating that this is "de-stressing", indicating a positive effect on mental health:

> *"Voluntary communal work. It is social, and I like the practical. It is also comforting/de-stressing to work with the soil." (Norwegian CSA member, comment linked to the question about benefits from CSA).*

In both countries, "higher prices" are seen as the most important drawback of buying vegetables from the CSA compared to supermarkets. CSAs usually employ organic cultivation methods, and it may be difficult for them to compete on price with large-scale producers of conventional vegetables. The perceived high prices of CSA vegetables come in addition to a prepayment model which low-income households can find challenging, especially in Norway where the payment is usually made in advance for the whole season and not spread into smaller, monthly payments, as in the UK. Making a prepayment for the vegetables is an important feature of CSAs, since it secures farmers with more stable

incomes and reduces economic risks related to harvest loss (Galt et al. 2019). However, the Norwegian payment system could also represent a barrier to membership, perhaps explaining why income levels among Norwegian CSA members are slightly higher compared to the national average than in the UK. On the other hand, it is notable that personal income levels of the CSA members are not significantly higher than the national averages in neither of the two countries, indicating that CSAs are not catering mainly for the most well-off citizens, in contrast to results of previous studies (Egli et al. 2023; Parot et al. 2023).

Our study shows that for the British CSA members active participation in agricultural production is usually voluntary for regular tasks and organised around social functions for harvests. In Norway, active participation is more strongly encouraged, and can be a condition of membership. There may be a trade-off in some CSAs between recruitment of members with time constraints, from both high- and low-income groups, and the increased social benefits that members report in relation to active participation.

UK respondents are more concerned with environmental impact when shopping for food. This corresponds with other studies which find a higher concern with climate change and environment in the UK compared with Norway (Newman et al. 2021), and it can also be linked with a difference between the two countries in terms of trust in national government (Wellcome Global Monitor 2020). Possibly, Norwegians have more trust that public authorities will ensure problems are solved, including environmental problems, while UK citizens, to a larger extent, see this as a responsibility that they as individuals need to take, for instance by becoming members of a CSA.

There are some important limitations to this study. We only received answers from individuals who are currently members of a CSA, and not from people who were previously members and left or who were never members. It is important to interpret results in the light of this. Furthermore, as all the respondents self-selected to answer the questionnaire, it gives a potential bias towards those members who are more content and motivated to respond. Self-reported data and respondents' perceptions regarding experiences including food consumption and mental health are generally less reliable than studies with control groups measuring actual changes. The respondents did not get any detailed guidance about how they were to interpret, for instance, "improved mental health" or "improved physical health". This was done to avoid a lengthy and complicated questionnaire that could have led to a loss of complete responses, but it means that there is a high risk of interpretation bias. Furthermore, the phrasing of questions about change of dietary habits drew out whether this was perceived as a benefit. Consequently, answers express both the occurrence of change (or not) and the appreciation of change (or not). We assume that few of those who perceive they are eating more or new types of vegetables, will not consider it a benefit.

Conclusion

The study, based on survey data with Norwegian and UK CSA members, shows that membership is associated with positive impacts on well-being and dietary habits. We have identified factors associated with higher member ratings of CSAs, and the likelihood of the CSAs having a perceived positive impact on mental health and vegetable consumption. These factors are: to involve members actively, to provide information

and courses about how to grow vegetables and to be credible in terms of producing a more sustainable food alternative. However, it remains important for CSAs to provide high quality and affordable vegetables, in sufficient quantities. There are substantial differences between organisational models of CSAs in the two countries, with Norwegian members being more involved in practical work than the British. However, the British CSAs successfully involve members in social activities, which may explain an association similar to the Norwegian with benefits and well-being.

Our research has reinforced the understanding of CSAs as a manner of sustainable food production which can contribute to life quality improvements of members, including in terms of increased vegetable consumption. Future research could further examine how CSAs can increase their positive impact on members' vegetable consumption and mental health, for instance in the nature of members' participation, and what types of recipes are provided. This information may prove useful not only for CSAs, but also for others seeking to increase vegetable consumption and address mental health challenges in the wider population.

Knowledge of factors that contribute to CSA member contentment and thus retention is important for the growth of this sector which, as long as CSAs follow agroecological or organic production methods, can have environmental benefits. Our data further indicate that there is also a sustainable dietary change associated with CSA membership, including among consumers with habitually lower consumption levels. For policy makers considering the merits of CSAs, this should serve as a useful signal when considering both agroecological systems development and non-clinical health interventions such as social prescribing.

Abbreviations

CSA Community supported agriculture
SFSC Short food supply chains

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Author contributions

ABM and DK conceived and designed the study. ABM carried out the data collection and the data analysis. SWM aided in the data analysis. ABM and DK wrote the paper with input from SWM.

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Availability of data and materials

The datasets generated and analysed during the current study are not publicly available due to the agreement made with the participating CSAs and their members, but are available from the corresponding author on reasonable request.

Declarations

Competing interests

The authors declare that they have no competing interests.

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