Listening to children voices in early stages of new product development through co-creation – Creative focus group and online platform

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A B S T R A C T

To tackle current nutritional issues like obesity, it could be valuable to involve children in the development of healthy food products that they will actively chose and enjoy. The aims of the present exploratory study were (i) to assess a methodology for early-stage idea generation through co-creation, for the development of healthy snacks with pre-adolescents, and (ii) to compare two settings, creative focus groups (CFG) and an online community (ONL). Three steps were defined to allow the gradual exploration of the topic and mutual learning throughout the process: (1) *Show & Tell*: photo taking and -elicitation to understand what children ate; (2) *Reflect*: a sorting task of the pictures to discuss and reflect on snacking practices (3) *Create*: an idea generation step, in which a newspaper article describing an idea for a new healthy snack was created. To increase engagement and creativity, gamification strategies were used. Our results demonstrated that children (preadolescents) can create new food product ideas with the proposed process, using enabling and creative techniques. In the CFG the trained moderator could steer the group to the co-creation goal. The setting facilitated teamwork and group learning, collaborative ideas considering preferences of peers and produced a few detailed and mostly actionable ideas. In the ONL less control over the process was possible. The setting produced many ideas varying in the degree of detail and actionability focusing on individual preferences. The feedback and observations from our study, particularly in the CFG setting, implied that the creative approach was highly engaging for participants. Further research is necessary to assess the potential of initial ideas developed by pre-adolescents.

1. Introduction

The rising prevalence of childhood overweight and obesity worldwide calls for healthy food options that children will actively choose. For a successful new product development, it is beneficial to involve children to a high degree, to tailor products to their preferences and needs. Also, the involvement of the next generation of eaters in future food scenarios might generally be highly relevant as sustainability assessments indicate the need for substantial shifts in our diets (Højlund et al., 2020; Willett et al., 2019).

To ensure that children's voices are included (Druin, 2002) in the creation of healthier food environments co-creation could be a valuable new approach. A paradigm shift in new product development has brought forward the concept of co-creation and open innovation where

stakeholders such as consumers participate as active partners, often with a focus on idea generation (Baldwin & Hippel, 2010; Ind & Coates, 2013). Currently, there is limited methodological research on how to involve consumers in co-creation activities for food idea generation, particularly children. In other fields, children have been successfully involved as co-designers of apps and educational software with creative and enabling methods (Alhumaidan et al., 2018; Guha et al., 2004; Kelly et al., 2006; TaxÉn et al., 2001; Thabrew et al., 2018).

For the idea generation of healthy food, preadolescents (9 to 12 y.o.) are a suitable age group. Compared to younger children, they possess an advanced nutritional knowledge and can access to their underlying drivers of liking to a higher degree (Zeinstra et al., 2007). Further, this age group transits from family driven to more autonomous food choices (Hill, 2002; Warren et al., 2008). Drawing on self-determination theory

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(Cormack et al., 2020; Gillison et al., 2019), a well designed co-creation initiative could potentially empower participating preadolescents to find their own way to pleasurable healthy eating while creating healthy products and meals that "speak" to children.

For applications with children, tasks and settings need to be tailored to the the skills and interest of the involved age group in order to achieve an optimal experience point between boredom and anxiety, which Csikszentmihalyi (1990) defined as flow. Ind and Coates (2013) stressed the need to engage co-creation participants in a reciprocally useful way, considering also the enjoyment and meaning for the participants. Further, gamification (e.g. Chou, 2015) can also enhance the immersion in tasks and their enjoyment.

Focus group settings are particularly suitable to facilitate collaboration and discussion in brainstorming activities, e.g. used by Banovic et al. (2016). Meanwhile, interactive online platforms might be an alternative to interact with the digitalized generation. Social media platforms encourage users to create and share content that reflects their opinions and ideas, offering new opportunities such as co-creation through crowdsourcing (Hoyer et al., 2010; Martini et al., 2014; Olsen & Christensen, 2015). Children might feel more free to articulate their opinions online than in focus groups, where they typically come to unfamiliar research facilities, which can be intimidating.

The aims of this exploratory research were:

(i) To assess a methodology for early stage idea generation with pre-adolescents in co-creation activities around healthy food through different outcome measurements (participation, content created and engagement)
(ii) To compare co-creation in two settings: creative focus groups and online communities, using the same outcome measurements (participation, content created and engagement)

2. Materials and methods

2.1. Procedure

The present study aimed to involve pre-adolescents in the co-creation of healthy snack[1] ideas to provide them with the opportunity to shape their healthy snacking. Snacking plays an important role in pre-adolescents' diets and has the potential to influence diet both positively and negatively (Dunford & Popkin, 2018; Loth et al., 2020; Taillie et al., 2015). Beyond the targeted age group, no specific demographics were defined. Therefore, a convenience sample of participants was recruited. In-line with Ind and Coates (2013) we assumed that everyone can be part of a co-creation team.

A multiple method setup with three stages was designed to allow the gradual exploration of the topic and mutual learning throughout the process. According to Bloom's taxonomy, learning evolves from concrete to abstract with the three main stages: knowledge, comprehension and synthesis (Krathwohl, 2002). In the revised taxonomy by Krathwohl (2002), creating requires remembering and understanding as well as analysing and evaluating as prerequisite.

In order to remember and understand, *Show & Tell* was defined as first stage, encompassing a photovoice exercise, i.e., photo taking and -elicitation. The visual picture taking approach is an enabling technique

often used to give children and youth a voice (photovoice), e.g. in obesity prevention (Darbyshire et al., 2005; Findholt et al., 2011; Martin Romero & Francis, 2020; Woolford et al., 2012) or weight management programs (Woolford et al., 2012). In the presented study, children took photos of their snacks and described them to each other.

The next stage, *Reflect*, aimed to analyse and evaluate current snacking practices with a projective sorting task of snack types collected in the *Show & Tell* stage. Sorting tasks are simple undirected, unstructured tasks frequently applied in focus group settings (Colucci, 2007), with the goal of eliciting participant's underlying perceptions and motives, which could be hidden by factors such as social desirability or lack of introspection (Mesías & Escribano, 2018). Sorting techniques, such as mind mapping, are also used as basis for brainstorming activities, helping participants to gain an overview and "make sense" of a topic (Gray et al., 2010).

The last stage, *Create*, had the goal of generating an idea for a new healthy snack. no further specifications for degree of healthiness or novelty were given to create a noncritical framework, which is known to enhance creativity (Osborn, 1953). A newspaper article brainstorming technique adapted from Gray et al. (2010) was used. This technique pretends that the idea is already created and is worth being reported by a newspaper, thus lowering the fear of not being able to come up with a relevant idea. The template for the article consisted of different aspects: headline, text field, image field and two speaking bubbles (Fig. 1).

The experience of participation in co-creation initiatives itself is likely to influence the outcome and is crucial for its success (Ind & Coates, 2013). Therefore, participants were asked to provide anonymous feedback at the end of the study, including interest, enjoyment, concentration, immersion, challenge, skills, importance, and work vs. play feelings. The wording of the questions is presented in Appendix 1.

The multiple method process was implemented in two settings: creative focus groups (CFG) and an online community (ONL) (Table 1 and supplementary material, Fig. 1). Both test settings were registered with the Norwegian data protection office (Nr. 347529 and 957208) and were reviewed by Nofima's Ethical Board regarding alignment with the Declaration of Helsinki. Participants were recruited as convenience sample, from after-school activities or school classes (Ind & Coates, 2013). Children and their parents received a one-page information letter understandable by children, a flyer explaining the project (Edulia, H2020 MSCA-ITN) and a form to be signed for parental consent and children assent. At the beginning, children were informed that they could leave the study at any time without any negative consequences. A small monetary incentive was paid to the sports club / school class as token of appreciation for their participation.

2.1.1. Creative focus groups (CFG)

Three groups of seven to eight children were recruited from two sport teams in the Akershus region in Norway. Most Norwegian children participate in some sort of after-school sport activity. Therefore, the recruitment did not necessarily result in particularly athletic children. The Involvement of sport teams had the advantage that participants knew each other, which facilitated group discussion and collaboration within the relatively short time of 1.5 h. Three groups with different characteristics were recruited. Group 1 consisted of 7 girls between 9 and 10 years old from a swimming team, whereas Group 2 involved a mixed gender group, composed of 4 girls and 3 boys that were between 9 and 12 years old, from the same swimming team. The last group (3) consisted of 7 boys between 11 and 12 years old recruited from a soccer team.

Participants were set up in the context of being product developers inventing new products at Nofima, where the study was conducted. As prop, lab coats were distributed. The focus group guide was pilot tested with two groups. Substantial adaptations were made after the first pilot regarding recruitment, context, and brainstorming technique:
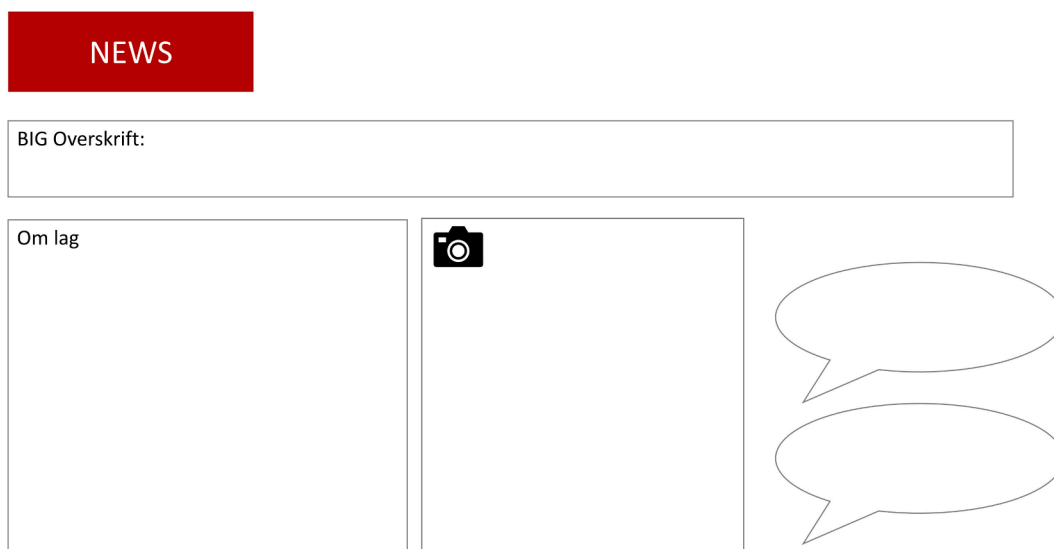
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[1] While the term "healthy snack" or "snack" is used throughout this publication the term "mellommåltid" (translated as "in between meals") was used in the study because snack implies unhealthiness in Norway (e.g. crisps, candy). "Mellommåltid" can be almost a real meal due to the eating structure in Norway. In most schools, children eat a cold lunch brought from home during a short break at around 11. When they come home at around 2 PM, they are hungry, so this is typically the time where they eat a "mellommåltid" which can be cold or a simple cooked meal, usually prepared by themselves. Therefore, simple hot dishes like pasta, are included as well.

Fig. 1. Template of the newspaper article brainstorming task in the *Create* part.

Table 1

Implementation of the multiple-method process in the two settings: creative focus groups (CFG) and an online community (ONL).

	CFG	ONL
	3 focus groups of N = 7, Ntotal = 21	1 online platform N = 52
	9–12 y.o.	10–11 y.o.
	1.5 h	3 weeks
	Trained moderator present	Self-administered (help page and support on request by teacher)
Show & Tell	Prior to the focus group, participants were asked to submit three photos of snacks that they typically eat. The focus group started with a "Taboo", guessing game: the participant received a card, with their snack picture and three to four words which comprised obvious descriptions that they could not utilize ("forbidden words"). They had to describe, during 45 s, one to two of their own snack photos, based on sensory characteristics and other properties, the rest of the group had to guess the food.	Participants created a food blog by uploading pictures of their own snacks , and describing the snack in the post. Commenting and liking of each other's posts was possible (social media setting type).
Reflect	Individual sorting of 27 images of snacks, selected based on *Show & Tell* and prior pilot tests. Followed by group discussion about participants' snacking habits, health perception and barriers and facilitators for choosing healthy snacks, based on commonalities and differences in the sortings.	On-screen individual sorting (same images as in CFG) with a mandatory description of the groups formed. Data was collected in the software Eyequestion. A feedback of the consensus configuration (whole group) was uploaded to the online community once all children had performed the task.
Create	Brainstorming in two groups of 3–4 children with newspaper article format. Presentation of idea generated to the other group followed by a short discussion about the feasibility of the invention.	Individual brainstorming with newspaper article format (same as in CFG). Uploading of idea on ONL platform. Voting on the best liked idea in two subgroups of the class was performed to select two winners.

- Recruitment: An effective collaboration between children that did not know each other was difficult to establish within the relatively short time. Therefore, children that knew each other were recruited.
- Context: Initially an alien story was used where children should help aliens to eat more healthily. The story was not appreciated by older children (11–12 y.o.), while a younger participant (10 y.o.) enjoyed it. Therefore the story was changed to a more realistic scenario where children were product developers.
- Brainstorming technique: Empathic design was replaced as it did not fit the new context of children as product developers.

A trained focus group moderator led all the groups. Two researchers assisted, one of them moderated the *Create* part where the groups were split in two subgroups. The implementation of the multiple method process is described in Table 1. The groups were filmed and recorded throughout. The feedback of participants' experience was collected orally as well as with the anonymous feedback questionnaire at the end of each focus group.

2.1.2. Online platform (ONL)

A 5th grade class (10–11 year old children), N = 52, from a town in the Akershus region in Norway, participated in the study as part of their Food and Health classes over several weeks.

The interface called "Din Matidé" ("Your Food Idea" in English) was set up on the software platform Padlet Backpack. The format was like a pinboard, from which participants could access the tasks via links (Fig. 2). The usability of the tasks via pinboard was checked in a pilot test of a small number of children of the targeted age group. For the study, an information text box was included to instruct children what to do, as well as deadline for each task. The three tasks were posted sequentially on the pinboard. Finished tasks were moved below, so participants always saw the current task on top. Each task was started during the class period and continued from home until the next class. Some permanently visible content was included on screen: "fair play rules", link to "help page" where questions could be posted to researchers, a link to the Edulia project page as well as a Fact or Fiction game related to sensory science and taste perception which participants could play during waiting times. An anonymous setting was chosen for the posts, to lower the threshold of "daring to post" and avoid bias in the

Fig. 2. Screen capture of the main page of the online community (ONL) study "Din Matidé" (Your Food idea).

judgements of the other participants. However, comments were not anonymized, so participant got ownership and responsibility of their own judgements of the posts of others. The online platform was initially explained by the researchers to all children in a classroom, using a screen to show the platform functioning. During the study, children were assisted by their teacher. The implementation of the multiple method process in the ONL setting is described in Table 1. At the end of the study, participants completed the anonymous feedback questionnaire (detailed in Appendix 1) and a ranking of tasks based on enjoyment. Researchers joined students to determine the winning ideas and give a small price (miracle berries that alter sour taste to sweet taste previously used in taste education (Lipatova & Campolattaro, 2016)) and discusss the results of the Fact or Fiction game.

2.2. Data analysis

2.2.1. Participation

Participation rates were calculated for the self-directed tasks (all ONL tasks and picture taking in CFG) as indication of method usability by children. Further, observations on children's participation during the CFG were reported.

2.2.2. Content created

The outputs from each task, photos and descriptions (*Show & Tell*), descriptions of snack groups (*Reflect,* only ONL), the text and drawings of newspaper article (*Create*) as well as the transcripts of the CFG discussions were considered for qualitative and also for quantitative analysis, when suitable. Content and transcripts were qualitatively analysed using inductive thematic analysis to gain an overview of the topics addressed following the procedure described by Clarke and Braun (2013). The inductive data-driven bottom-up approach created themes from the text without prior theory, which fitted the scope of this exploratory study. The material was coded and categorized into themes in excel spreadsheets by the first author, who is a sensory and consumer scientist. Codes and themes were reviewed independently by the co-authors of the study (a trained focus group moderator and two senior sensory and consumer science researchers). Through discussion, some of the themes were reformulated. Various strategies were utilised during data collection, coding and analysis, to ensure data trustworthiness (Morse, 2015): careful documentation of CFGs via video recording and transcription, intensive listening and probing by a trained moderator, engagement in all focus groups by the leading researcher, documentation of data coding, researcher triangulation and debriefing. It was

beyond the scope of the analysis, to check with participants if results aligned with their experience (member-checking). The lack of member checking could have induced an adult centric bias (Petr, 1992) of the thematic analysis, potentially not reflecting the participatory approach fully. However, themes were extracted to provide the reader an idea of the type of insights that could be gathered with each method.

Some quantitative evaluations performed with R, version 4.0.4 are also included. The number of pictures of different types of snacks in the *Show & Tell* task was calculated. For the *Reflect* task of the ONL setting, a group configuration was calculated based on the individual sorting configurations using DISTATIS (Abdi et al., 2007) with the DiSTATIS R package (Beaton et al., 2019). Children's descriptions were analysed using inductive coding and the identified themes were each projected as dependent variable by linear regression with the first two components of the product configuration as independent variables. Only themes used by more than one participant were considered.

2.2.3. Engagement

The anonymous feedback questionnaire was evaluated by calculating averages and standard deviations for the rating-based questions and frequency for the multiple-choice question. For the ONL setting, the most frequent ranking of task enjoyment is also presented. Further, observations by researchers and oral feedback by participants were considered.

3. Results

3.1. Show & tell

3.1.1. Creative focus group

Most participants (20 out of 21) sent one to three pictures of snacks prior to the focus group, as requested. Most photos showed the snack on a plate or in the original packaging (Fig. 3).

The guessing game "Taboo" was observed to be suitable ice breaker to the focus group, as well as a starting point to explore participants' perception of their own snacking habits. The descriptions in the "Taboo" game were quite elaborate regarding sensory descriptions but focused mainly on the visual and textural modalities (Table 2). Taste and flavour attributes were used more scarcely. When the moderator asked about the taste and flavour participants were often in lack of words, e.g. saying that it tastes tasty.

3.1.2. Online platform

In the food blog, 47 out of 52 participants made from 1 to 17 posts, resulting in 175 posts. Social media seemed to have influenced the selection, presentation and description of the snacks (Table 2). As exemplified in Fig. 3, many children depicted the snack itself as well as the setting in an original way. Pictures of non-standard snacks for the Norwegian context were frequent, e.g. green coloured pasta, mandarin juice or pancakes with coconut milk. Also, changes in standard recipes to make foods healthier or tastier were mentioned in the posts, e.g. healthy pancakes. Compared to the focus group, more unhealthy snacks and sandwiches were mentioned in the food blog (e.g. desserts were included 11% of pictures), whereas fruits were less frequent (Table 2). In addition, a higher percentage of snacks involved cooking or baking: 32% of the dishes in the ONL vs. 14% in the CFG. In some cases, preparation steps were documented in multiple posts. Whole meals including drinks, instead of single foods, were more frequently depicted (Fig. 3).

Matching the social media setting, the pictures served as the main communication tool. As shown in Table 2, the text used to described the snacks was short and often accompanied or replaced with emojis (in

23% of posts) depicting ingredients or hedonic and emotional associations (e.g. hearts and happy smileys), as well as hashtags (in 2% of posts), such as #mellommåltid, #yum, #boring. Descriptions of how snacks were prepared were also included (in 2% of posts).

Discussion and liking of the posts between peers were lively, which likely increased engagement and, consequently, the number of posts. The social media setting also enabled peer influences on food choices. At times, the same snack was posted by different participants. In two posts this was explicitly pointed out: *"I am a copycat"*, *"the same pancakes as (name of peer)"*. A girl mentioned at the end of the study that she was inspired to try new snacks that her classmates had posted.

3.2. Reflect

3.2.1. Creative focus group

After the individual sorting, the moderator asked participants to describe the groups they had made aiming to generate a consensus map. The sorting criteria used by participants steered the discussion and led the path to the last, creative step. The consensus map was not finalized as it would have taken too much time. In The following, topics that emerged from the discussion are presented using a few verbatim examples (names of children have been changed to assure anonymity):

- Healthiness is nuanced within food group
- Odin, 12: *"Pizzasnurrer»* (Norwegian pizza rolls) can be healthy, yes.*"
- Maja, 10: *"Not all crackers are healthy"*
- Convenience and availability of different foods at home and on the go
- Filip, 12: *"I just eat whatever is in the fridge."*
- Emma, 10: *"Emm it's like this, on Tuesdays when I play violin before swim practice, my mum just must make something quick because she comes straight from work and we have to drive directly from violin to my swim practice. Then she usually brings hot dogs or something."*
  Moderator: *"Then it's important to have something that is fast to make and fast to eat because you are going from one activity straight to another one?"*
  Emma, 10: *"Yes, but she doesn't like that we eat hot dogs every Tuesday, so she tries to find something else to serve us that is a bit healthier."*
- Preferences for hot food and fruits
- Maja, 10: *"I like pasta quite well, and then I like pancakes, muesli bar and then fruit."*
- Ada, 10: *"... I would love to have more fruit, because lately I have become very fond of fruit."*
- Cooking skills as well as time were identified as limiting factors to eat hot food:
- Ada, 10: *" ... I'm allowed to boil stuff, but I'm not allowed to use the oven, but I wouldn't dare anyhow."*
- Lukas, 12 explaining why he is not allowed to make pancakes after training: *"Emm, maybe so I won't tear down the whole kitchen."*
- Emil, 12: *"It takes such a long time to make a toast."*
- Importance of healthy snacking in the context of sport.
- Emil, 12: *"Maybe not eat something too unhealthy before exercising?"*
- Odin, 12: *"Emmm I usually choose the healthy before, or instead of the unhealthy when I'm going to do some exercises or if I have a (soccer) game…"*

3.2.2. Online platform

A consensus configuration (Fig. 4) obtained from the individual sorting tasks revealed three main snack groups that represent a common perception among participants. Fig. 4a displays the snack configuration: snacks placed close to each other on the plot were sorted in the same
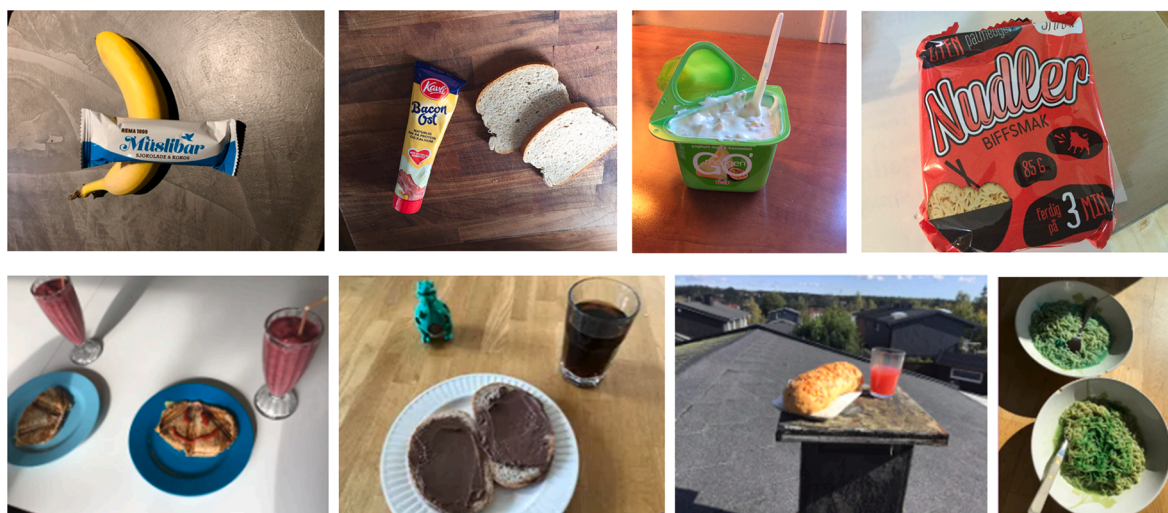
Fig. 3. Examples of the photos uploaded in the *Show & Tell* task in the creative focus groups (CFG) (top row), and online community (ONL) (bottom row) setting.

group by many children. Fig. 4b displays themes other than food categories mentioned by at least two participants to describe the sorting categories. The first component (PC1, explaining 51% of variance) separated fruit and vegetable snacks from other snacks. The fruit and vegetable group was described as "healthy", "simple" and "snack" (*mellommåltid*). Further, the second component (PC2 explaining 5% of variance) separated sandwiches from other snacks. Sandwiches were described as "breakfast" and "yuck". The third group was composed of a variety of snacks including many hot snacks on the upper part of PC2. These snacks were described as "warm", "yummy" and "dinner".

3.3. Create

It was left free to the participants to use the news paper article template (displayed in Fig. 1) as they wanted. Many wrote the snack name in the headline, specified the ingredients and / or sensory attributes in the main text field, drew a prototype in the image field and wrote what others would say about their invention (projective approach) as well as slogan-like texts (like those one could find in a commercial) in the speaking bubbles.

3.3.1. Creative focus groups

All six brainstorming subgroups were able to come up with an idea for a healthy snack. The ideas were explained and visualized through drawing, gesturing and spontaneous prototyping with available props on table to each other, resulting in relatively rich outputs where different aspects of the product ideas were considered. The product ideas were also a compromise: in most brainstorming groups, children tried to include everyone's preferences. The product ideas focused on the two snack groups: Easy hot food ("Naminam burger", "Heart-warming pasta" and "Big toast") and fruit snacks ("NJ2 Fruit salad", "Epan", "Graft"). The newspaper articles of the groups offered ideas for product formulation, marketing, and branding (Table 3).

Product formulation: Dinner-like snacks were "better-for-you" versions of existing snacks by including healthier ingredients, such as vegetables, whole wheat, and seeds. The heart-warming pasta had the aim of tricking children to eat healthier by hiding the healthy vegetables within the pasta: *"And then parents can lure their children to eat vegetables".* The group further thought of a new shape, (heart shapes) that can be easily eaten with a spoon. Two groups thought of a bigger than normal version, maybe inspired by fast food commercials: "Big toast" and "Naminam burger". The "Naminam burger" was composed of ingredients from ethnic cuisine, sushi, and tikka masala.

Branding and marketing: Many of the product names were creative

and potentially appealing to the age group. For example, the smoothie name "Graft" combines guacamole and "saft" (juice in Norwegian) and potentially an association with the word "kraft" (energy in Norwegian). The "Heart-warming pasta" implied an emotional association having young girls as target consumers in mind. Other marketing ideas included slogans ("Naminam is very naminam") and surprises added in the packaging (discussed in the "Big toast" and "Heart warming pasta" groups).

3.3.2. Online platform

The individual brainstorming in the ONL resulted in 41 posts (from 52 participants), 38 of which corresponded to product ideas. The individual brainstorming gained more ideas than the CFG, varying in the degree of detail, healthiness, and applicability. Participants proposed both healthy and unhealthy snacks (e.g. dessert-like snacks). In addition, some ideas were more wishful thinking than feasible products, e.g. *"It should be a healthy ice cream that has chocolate with vanilla flavour that tastes like normal ice cream"* or "Eternal potato gold" where the potato chips bag never gets empty. While other ideas were quite detailed as well as actionable.

Product formulation: The snack idea "MIXI" pointed out that there is an optimum of novelty: *"Not too boring and not too extreme".* As in the CFG "better-for-you" versions were suggested: *"super, both healthy and unhealthy".* This time the unhealthy was hidden in the healthy to trick parents, contrary to the idea proposed in one of the focus groups (parents tricking children in eating healthier). Two ideas focused on new shapes for finger food: sushi shaped in a sphere and pizza on a stick to "not make your fingers dirty". Sensory specifications were identified. In two ideas sweetness was pointed out as a must: *"Should be sour but also sweet", "Good and sweet".* Besides, two ideas described the texture in detail, indicating how it should and should not be, which suggests the importance of this sensory modality for some children,

Branding and marketing: some snacks had creative product names and were praised with slogans. Emotional associations were identified: *"When you drink this fantastic juice you become happy and your day brightens up"* and *"When you eat it you feel that your worries disappear".* Eating occasions were mentioned, which did not emerge in the focus groups. The chocolate filled pasta was suitable for Saturday night[2], whereas a fruit bar was defined as suitable for training. A futuristic idea rounded it off suggesting to replace food with pills that could be

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[2] Saturday is for many Norwegian children the day when they are allowed to eat sweets.

Table 2

Snacks depicted in the pictures sent by more than 5% of children in the *Show and Tell* task in the creative focus groups (CFG) and an online community (ONL) settings. The number of children who sent pictures featuring each type of snack and examples of the descriptions are shown.

	Number of children	Snack in photo (Show)	Descriptions of snack (Tell) mentioned ingredients / components of the snack excluded, only a selection of used emojis displayed for ONL
CFG, 58 photos	12	Fruit	Healthy, Banana: yellow, long, looks a bit like a half moon, soft, curved, can turn brown if it's old, unique flavor, before exercise, healthy, wide range of usage (also baking), Apple: green or red, something white inside, stem on top, round, a bit hard, but also a bit soft if it falls on the ground, a bit juicy, some are dry and some are juicy, a bit sweet, tastes a bit green, tasty, very good
	10	Flavored yoghurt	very soft so you can swallow it at once, little thicker than water, liquid, viscose, white with black spots (Vanilla), for breakfast, eat it with a spoon
	10	Granola bar	contains chocolate and grains but you cannot feel it (grains), tasty, after exercise
	8	Sandwich	round, squared, soft, hard (crisp bread), has holes (Polar bread: special type of Norwegian bread), red, taste like fish (mackerel in tomato), have a lot in my place (spreadable cheese and bacon)
	8	Cereal	dry if you don't add milk, very small (oats)
	5	Instant noodles	Red, squared (packaging), chew without breaking teeth, looks like braided into each other (dried noodles), can be soft and hard, tastes like chicken and beef, tasty, boiling required, eat it with spoon or fork
	4	Vegetable	Carrot: orange, little hard, a bit long, can be a bit thick
ONL, 175 photos	54	Sandwich	It tasted very good, home-made snack (mellommåltid), smiley 😊, for training, this is what I ate yesterday #mellommåltid, good for me and my little brother
	19	Dessert-like (cookies, ice cream, cake)	mmmh 😊, 😋, extremely good, 👍, 🍦, home-made, from Oslo, a small cookie on the side, I felt better after, little snack,
	19	Milk and chocolate milk	Ultimoooooooo (chocolate milk brand), my breakfast #yummy It was so good ❤️
	15	Fruit	yummy, sour but good 😊, #boring,
	15	Juice	Fresh, home-made, breakfast, (ginger juice) refreshes you
	11	Pasta	pasta is good, #yummy, #goodfood, a bit late, but here is my snack from Friday 🥰❤️🤍🤍🤍🖤
	11	Pancake	tastes very good, the exquisite, 🍦🍦🍦, can it get any better, a little comfort must be allowed, healthy pancakes, not my usual

Table 2 (*continued*)

Number of children	Snack in photo (Show)	Descriptions of snack (Tell) mentioned ingredients / components of the snack excluded, only a selection of used emojis displayed for ONL
		snack, but it was good 😊 🍴, like (name of peer) his pancake, now it is finally finished (referring to the cooking process) 🍴 😊, home-made
10	Vegetable	little, red but also very good (cherry tomatoes), from the garden,
9	Smoothie	yummy

produced in any flavour.

Children's voting for a winning idea determined the idea "Sushi ball", a sphere shaped sushi as winning idea in one subgroup, and "Eternal potato gold", potato chips bag that is never empty, in the second subgroup. Particularly in the second subgroup, the voting did not determine a healthy idea.

3.4. Participants' feedback

Participants' feedback was generally positive for both settings. However, scores tended to be higher for the creative focus group (CFG) than for the online community (ONL) (Fig. 5). In both settings, the lowest scores were found for the item Challenge which could have been related to a different phrasing, however. In the CFG, Challenge was mainly rated low by the group 3 composed of the oldest children, 11–12 year old boys. The majority of participants rated their experience as "both, working and playing" in both settings. The oral feedback of participants in the CFG indicated that they enjoyed the *Create* part the most and found the *Reflect* part somewhat boring. In the ONL setting, the food blog as *Show & Tell* was ranked as favourite by the majority (64%) while *Reflect* was ranked least favourite by the majority (62%).

4. Discussion

The present work is a first methodological attempt to include preadolescents in early idea generation stages through co-creation in a food-related context. In the multiple method setup, the first two steps explored preadolescents' snacking habits as a basis for finding ideas for new healthy snacks. In the following sections, the process and the resulting ideas are discussed from a methodological perspective, and reflections on weaknesses and strengths of the two settings are provided.

4.1. Show & Tell – Reflect – Create as multiple method process for co-creation

In the *Show & Tell* stage, the photovoice helped participants and researchers to generate group knowledge of current snacking practices. In the CFG this step probably reflected the status quo quite accurately, as participants did not know beforehand about the usage of the snack photos they were asked to send in as preparation for the focus group. Further, the guessing game instructed and enabled participants to describe their snacks with sensory descriptions. Meanwhile, in the ONL setting, pictures were openly shared, liked and commented. As previously observed for slightly older adolescents (Holmberg et al., 2016), food posted in a social media setting focused on special occasions. More unhealthy snacks were included, but also food that required a higher preparation degree. While the authorship of the posts was intentionally hidden in the ONL setting, many children wanted to be associated with their posts and therefore added their name in the comment field. Kietzmann et al. (2011) identified identity, conversations, sharing, presence, relationships, reputation and groups as functional blocks of
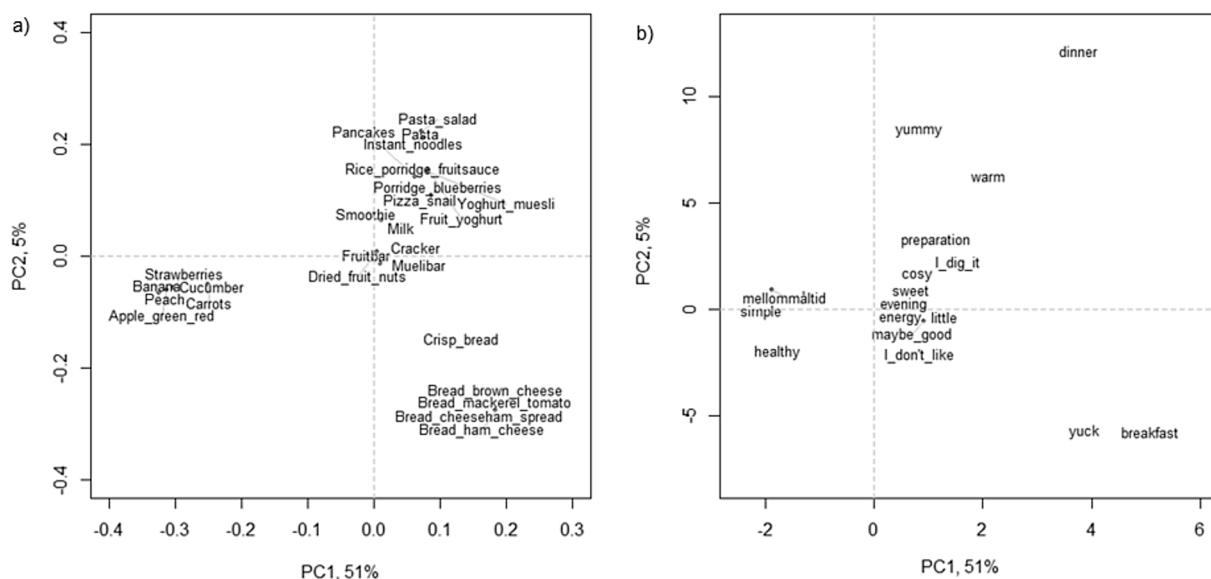
Fig. 4. a) Consensus configuration of snack images obtained from the individual responses of 46 participants in the sorting task performed in the online community (ONL). Snacks placed close to each other on the plot were sorted in the same group by many children. b) Themes other than food category mentioned by at least two participants to describe the sorting categories were projected by linear regression.

social media indicating that the food blog content was dependent on psychosocial aspects in peer-to-peer interactions.

In the *Reflect* stage participants analysed and evaluated current snacking practices. Participants sorted snacks according to pleasure, healthiness but also eating occasions. In the focus group setting an in-depth learning about barriers and facilitators of pleasurable healthy snacking was possible. Further, the trained moderator could then steer the discussion to "what is missing". This possibility was not available in the ONL setting, as the exercise was individual and was not followed by a discussion.

In the final *Create* stage, most participants (38 out of 52 participants in the ONL and all six subgroups in the CFG) were able to come up with a snack idea. Most ideas were based on well-known and -liked snacks and incorporated some new elements, for example the inclusion of healthier ingredients or ways to increase product appeal through marketing & branding.

4.2. Evaluation of CFG and ONL setting

The implementation of the multiple method process in the two settings led to different outcomes. The recent Covid-19 pandemic highlights the importance of establishing suitable online settings. The characteristics of the multiple methods process in the two settings are summarized in Table 4.

The three tasks *Show & Tell, Reflect, Create* were designed to build on each other in order to facilitate the last *Create* stage. This learning could not be confirmed with the presented exploratory setup. In the CFG *Create* part, all ideas considered healthiness and topics that had come up in the previous tasks were taken as basis, e.g. hot meals that are easy to prepare in the context of limited cooking skills which could indicate that participants included generated knowledge from the previous steps. In the ONL this evolution was less apparent. The food blog already produced some creative contributions and would have certainly been a good basis for the *Create* part. However, the tasks were implemented more than a week apart and therefore the food blog might not have been very present

for the participants at the time they invented a new snack. Further, the individually performed *Reflect* task without discussion was probably not suitable to critically assess current snacking habits or serve as inspiration of what is missing.

The ONL *Create* stage represents a crowdsourcing approach for ideas. Some individual crowdsource contributions were pointing towards an innovative potential while ideas from group brainstorming were more detailed but also a compromise. The difference in the amount of detail depending on setting has been described previously by Schweitzer et al. (2015) in a non-food context with adults: focus groups developed ideas more fully, while competitions in crowdsource settings were able to generate many ideas in an efficient way. They suggested the provision of examples in online settings to increase the amount of details and mentioned that more social interactions in online settings would be beneficial. Putman and Paulus (2009) compared the originality of ideas generated by groups and individuals and classified the individual ideas to be more original. However, when it comes to food, a group compromise that already considers different preferences might be a suitable approach. Further, the pleasure of brainstorming in groups should not be underrated. The *Create* part was children's favourite task in the CFG but not in the ONL setting which should be an important criteria for successful co-creation projects (Ind & Coates, 2013).

The role of the trained moderator in the CFG might have been decisive for the degree to which children considered health aspects. In the *Show & Tell* and *Create* stages of the CFG children posted more health directed snacks than in the same stages of the ONL setting. Further, in the ONL a particularly unhealthy option was voted as favourite in one of the two subgroups indicating that peer-to-peer interactions are difficult to predict and will not always align with the healthy eating goal. In the *Create* stage, the strategy to "trick someone by hiding" came up in both settings, however from different viewpoints. In the CFG, the view of parents wanting to trick their children to eat healthier by hiding the healthy in the less healthy was taken, whereas in the ONL the view of the child to trick parents by hiding the unhealthy in the healthy was taken. This suggests that in the supervised CFG setting, participants partly

Table 3

Thematic analysis of ideas generated in creative focus groups (CFG) and an online community (ONL), as well as verbatim extracts of the discussion in the case of the CFG.

	Theme	CFG 6 ideas, group brainstorming (N = 3–4)	ONL 41 ideas, individual brainstorming
Product formulation	Optimum of novelty		- The idea "MIXI" was described as: *"Not boring and not too extreme"*
	Better-for-you	- The "NAMINAM Burger" was made healthier by including whole wheat bread and guacamole (it was debated if guacamole can count as vegetable) - "Big toast" with lettuce and tomato - "Heart warming pasta" with vegetable or fruit filling	- Porridge with fruits - Pasta containing apple - Bun with blueberries - Carrot or apple with chocolate core (3 ideas) *"super, both healthy and unhealthy"*

	Trick children (hide healthy)	- The "Heart warming pasta" group wanted to make different types of fillings to cater to different tastes, e.g. fruit fillings for children who do not like vegetables. Also the hiding of vegetables was mentioned as a trick:
		  "…and then there is hidden some vegetables in between."
		  "And then, and then parents can lure their kids."….	

	Trick parents (hide unhealthy)		- Carrot or apple with chocolate core (3 ideas) *"smart, as parents think that one is eating vegetables and they taste very good"*
	Sweet is tempting		- Many ideas posted were dessert-like - Pasta with apple flavour was described the following: *"Should be sour but also sweet"*. - Porridge with raspberry and blueberry flavour was described: *"Good and sweet"*
	Specific textures		- Description of "MIXI", a combination of smoothie and muesli: "it is a thick smoothie (ice cream consistency)." And *"It's a nice mix and not a thin/runny smoothie."* - Description of "Sugar free filled pancakes, tropical taste": *"The filling should be liquid but not sticky. And even if it is liquid it should not be like that it comes everywhere and it should also be jelly-like."*
	New shapes	- The idea for the "Heart-warming pasta" focused on making cute shapes: *"It can come in many different fun forms."* In the discussion the advantage of eating it with a spoon was mentioned.	- Sushi ball: *"Seaweed covers the filled rice ball"* and Pizza on a stick (2 ideas) focused on finger food. One pizza on a stick was described with: *"You don't make your fingers dirty…"*
	Bigger than normal	- "NAMI NAM!": *"It's a big burger. It is so big."* - "Big Toast"	- Large Oreo cookie: *"Like an Oreo but they are so small. So, this is big!!!"*
	Ethnical food	- The "Naminam burger" combined Indian tikka masala and ingredients from sushi	- Sushi ball
	Easy hot food	- Heart warming pasta where boiling water is added to cup - Big Toast and Naminam burger that just need to be heated up	- Ready made fruit filled pancakes - Ready made porridge with blueberries - Pasta (with apple or chocolate filling) - Pizza on a stick (finger food)
Branding and marketing	Creative product names	- Heart warming pasta - NAMI NAM burger (nam = yummy) - GRAFT (associated with saft = juice and maybe guacamole as well as kraft (=energy)): for a fruit puree drink - EPAN (mixed the words for apple and banana in Norwegian) for a fruit hybrid of apple and banana	- MIXI: smoothie with muesli mix - Bruskrus (=sparkling cup) for a soda drink - Eternal potato gold: for potato chips where the package never gets empty - Epjodri (mix of apple and strawberry in Norwegian): for a fruit juice
	Packaging	- The "Heart warming pasta" could be eaten in the packaging cup - For the "Hear warming pasta" and "Big Toast" the addition of a surprise in the packaging was mentioned	- See through packaging: A caramelized apple with chocolate: *"In the shop the apple should be in a see-through bag so everyone can see it."*
	Slogans	- Word play: *"Naminam is very namnam."*	- Appraisal: *"World's best"* was used twice as well as *"Epjodri makes your day brighter"* - Food that talks: *"blend me"* for a shake
	For specific occasions		- Pasta with chocolate filling was specifically invented for Saturday night.2 - Fruit and vegetable bar: *"Can be a good training bar."*
		- "Heart warming pasta" suitable for girls: *"And then they are shaped like a heart, for small girls maybe…"*	

Table 3 (*continued*)

Theme	ONL	CFG
	41 ideas, individual brainstorming	6 ideas, group brainstorming (N = 3–4)
There are consumer segments among children as well		
Emotional associations	- Description of "Epjodri": "*When you drink this fantastic juice you become happy and your day brightens up*" - Pasta with chocolate filling was described as: "*When you eat it you feel that your worries disappear*"	- "Heart warming pasta"
New ways of eating	- A machine that can produce pills in any flavour to replace common food. "*I get full at once*"	

identified with the adult's view point but were focused on their peer's view in the unsupervised ONL setting. Previous research indicated that children's and adolescent's food choice is highly dependant on psychosocial needs to be accepted by peers (Roberts & Pettigrew, 2013; Stead et al., 2011) and that more health directed food choices were made when adults were present (Fitzgerald et al., 2010; Warren et al., 2008). In game theory, a killer type, someone that wants to test the boundaries of the game, has been identified as opposed to more constructive types, explorers, socializers and achievers (Bartle, 1996), suggesting the need for strategies on how to navigate group dynamics in ONL settings. The lack of control has been noted as disadvantage of online settings previously (Schweitzer et al., 2015).

In summary, the hereby described results indicate that, with the proposed processes, preadolescents can co-create food product ideas, that could be applied in the early development stages of innovative healthy food and meals. However, focus groups and online settings, had some particularities: CFG facilitated teamwork, a clear group learning through the defined process, enhanced engagement and produced a few collaborative ideas considering preferences of peers. The ONL produced many ideas, varying in the degree of detail and actionability, focusing on individual preferences.

4.3. Limitations and further research

The present study focused on first product ideas assessing them in a comparative way between the two settings from the researchers' perspectives. Further evaluations could include assessments by R&D experts as e.g. done by Christensen et al. (2017).

In the ONL setting the flow in the tasks and desired evolution was not clearly observed. This points to the necessity for further development (e. g. closer in time, more instructions given between tasks, more steering possibilities).

The results suggest the feasibility of extending the approach to other stages of the development process of new products or meals. Initial ideas could be critically evaluated in a next step and then prototyped in iterations in collaboration with chefs drawing on the concept of design thinking (Veflen, 2014). In such extended studies, product success but also the effect of participation in preadolescents' healthy eating self-efficacy and diet variety should be assessed. Olsen (2019) highlighted that creative engagement of children with chefs could be well-suited as intervention studies to diversify children's diets.

In the present study, ethical considerations were mainly focused on ensuring parental consent and children's assent, as well as being aligned with data protection rules. Commercial applications might need to consider other ethical aspects like intellectual property management strategies (Tekic & Willoughby, 2019). Children's right to participation needs to be balanced with their right to protection (Water, 2018).

We acknowledge that some of our findings might be specific to the recruited convenience sample and the Norwegian context. Children's right to autonomy and self-determination is rated especially high in Norway which might have helped the outcome of this study (Kjørholt, 2007). Further, the ONL approach requires the access to an electronical device as well as the knowledge to operate it, which are not necessarily available to all school children elsewhere. In the convenience sample that we recruited, children from different backgrounds, such as lower socioeconomic and immigration status, might have been underrepresented. Besides applications in other countries and cultures, future research could aim to recruit children from families that are most disadvantaged regarding dietary health, e.g. children from families of low socioeconomic position.

5. Conclusion

There is limited methodological research aiming to involve children actively in the idea generation of healthy food. Our results indicate that children (preadolescents) can create new food product ideas, with the
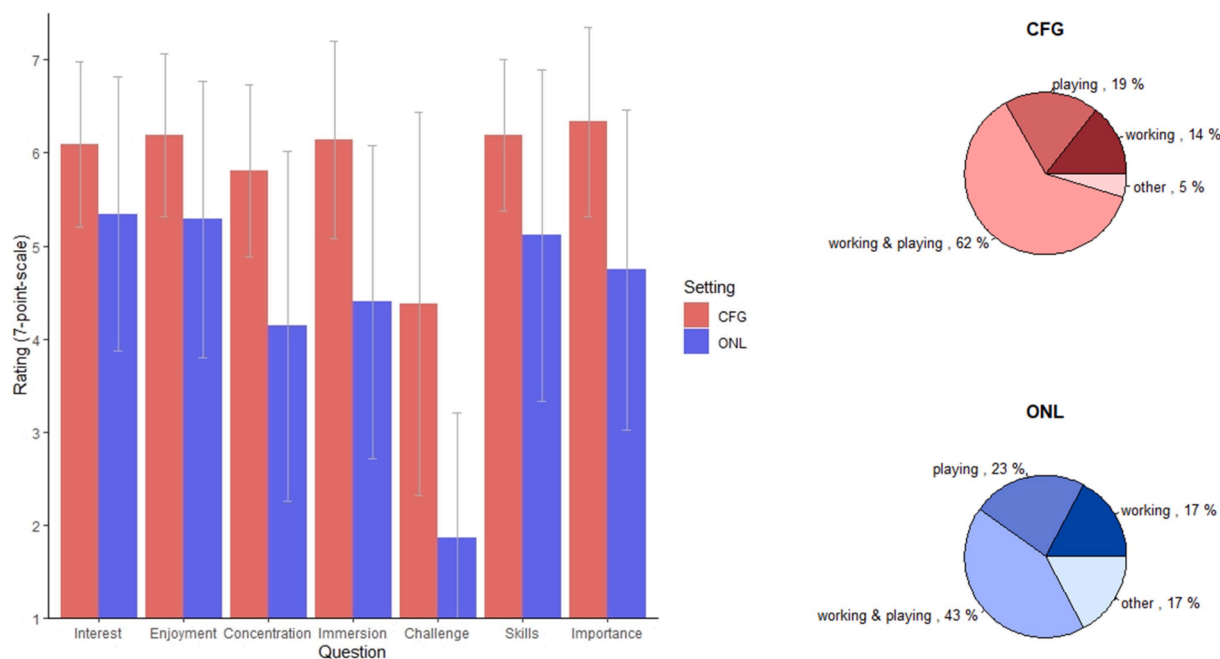
Fig. 5. Average ratings provided by participants to different aspects of their experience in the creative focus groups (CFG) (N = 21) and online community (ONL) (N = 35).

Table 4
Comparison of the multiple-method process in the two settings, creative focus groups (CFG) and an online community (ONL).

	CFG	ONL
Show & Tell	Reflected status quo of snacking	Reflected status quo of snacking as well as possibilities for new snacking options (more inspirational), peer related psychosocial aspects of snacking
Reflect	In depth group discussion on drivers of liking, healthiness and eating occasion of snacks leading towards what is currently missing	Mapping of snacks and associations with liking, healthiness, eating occasion
Ideas	Few (6), detailed descriptions, group preferences (compromise, team work), relatively healthy	Many (38), varying degree of detail, individual preferences, 50% relatively healthy, "crowdsourcing" approach
Timeframe	3 sessions of 1,5h	3 weeks
Insights in snacking habits	To high degree	To a lesser degree, peer related psychosocial aspects
Control over process	High through trained moderator	Low
Process evolution	Indication for evolution	Not clear
Participant's engagement	High	Medium - high

proposed processes, using enabling and creative techniques, both in focus groups and online settings. Focus groups produced few and elaborate ideas as well as extensive insights in children's snacking practices and online setting produced many but in trend less detailed ideas as well as insights in peer related psychosocial aspects of snacking. The

feedback and observations from our study, particularly in the creative focus group setting, implied that the creative approach was highly engaging for participants. Further research is necessary to assess the potential of co-creation in real product development cases considering product success but also participating children's experiences and potential short- and long-term effects on healthy eating self-efficacy and dietary diversity.

CRediT authorship contribution statement

Martina Galler: Conceptualization, Methodology, Investigation, Writing – original draft, Visualization. **Kristine S. Myhrer:** Methodology, Investigation, Writing – review & editing. **Gastón Ares:** Conceptualization, Writing – original draft, Supervision. **Paula Varela:** Conceptualization, Methodology, Writing – original draft, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

Feedback questionnaire used to evaluate participants' experience. The first seven questions were rated on a 7-point-scale (1 = not at all, 7 = very much), whereas the last question was multiple choice.

Aspect	English question
Interest	How interesting was it?
Enjoyment	How much did you enjoy what you were doing?
Concentration	How concentrated were you?
Immersion	How immersed (engaged) were you in the activities?
Challenge	Was it difficult?
Skills	How skilled were you at the activities?
Importance	How important was the activities?
Work or Play	Did it feel more like: (a) working; (b) playing; (c) both; (d) none of the above?

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodres.2022.111000.

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