LIFANA – Lifelong Food and Nutrition Assistance

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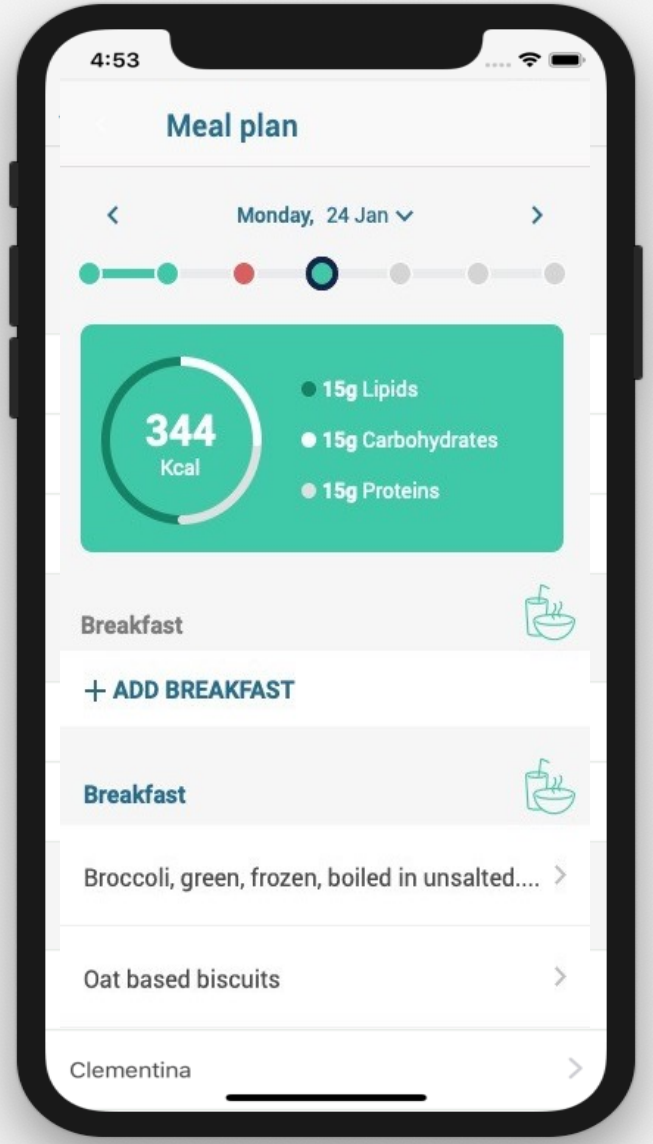
www.lifana.eu

Goal

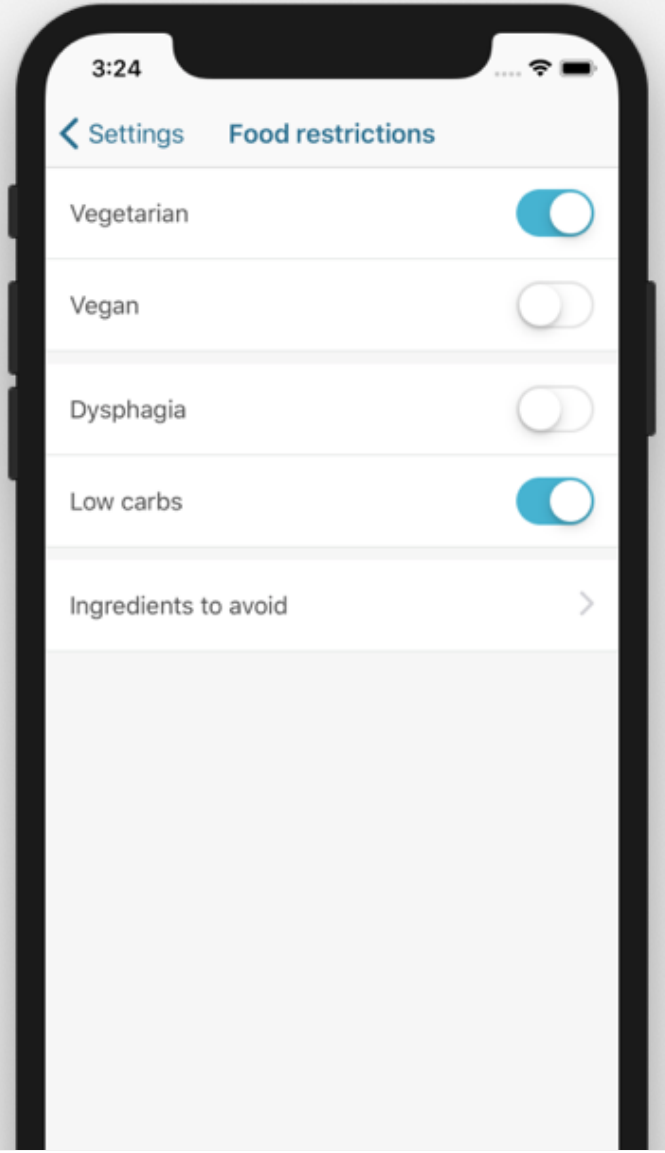
- Help users to keep BMI stable at higher age and changing metabolism
  - Prevent malnutrition (over- and undernutrition)
  - Prevent muscle loss
  - Change eating habits

Meal planning instead of food logging

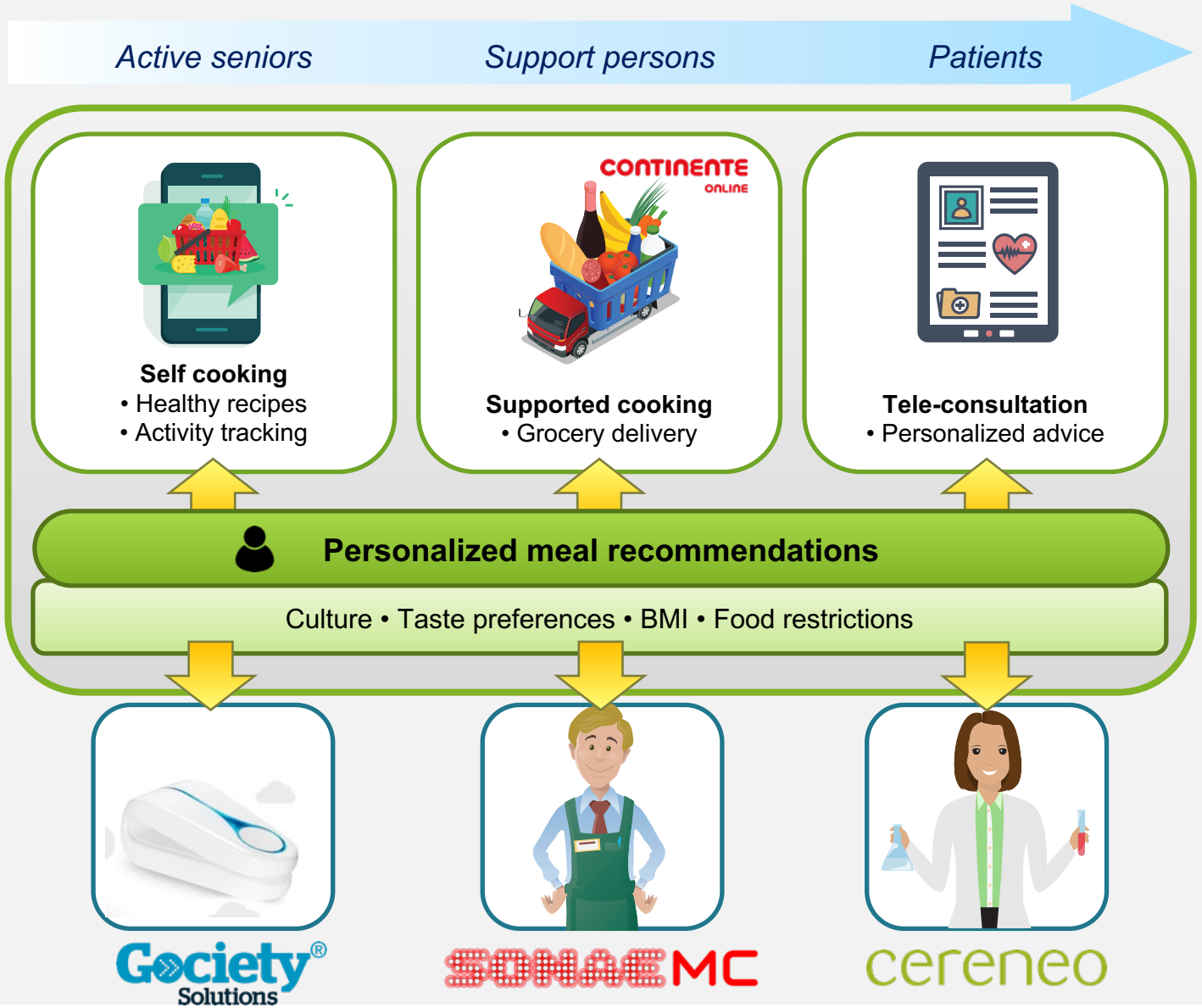


Personalized meal plans

- Single day or full week
  - Balance between fish and meat
  - Variety of meals and ingredients
  - Caloric and protein goal
    - Physical activity level
- Food restriction profiles
  - Ingredients to avoid
  - Ingredients to exclude
  - Create custom food restrictions
    - Swallowing problems
- Allergenic substances



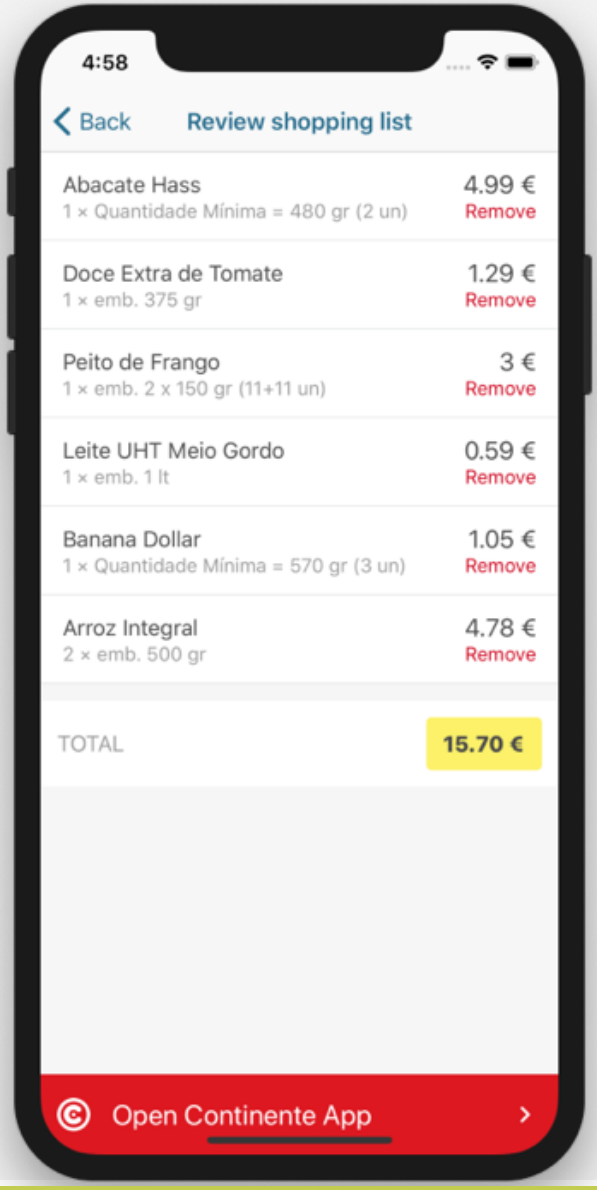
Support for all phases of ageing



Shopping assistance integration

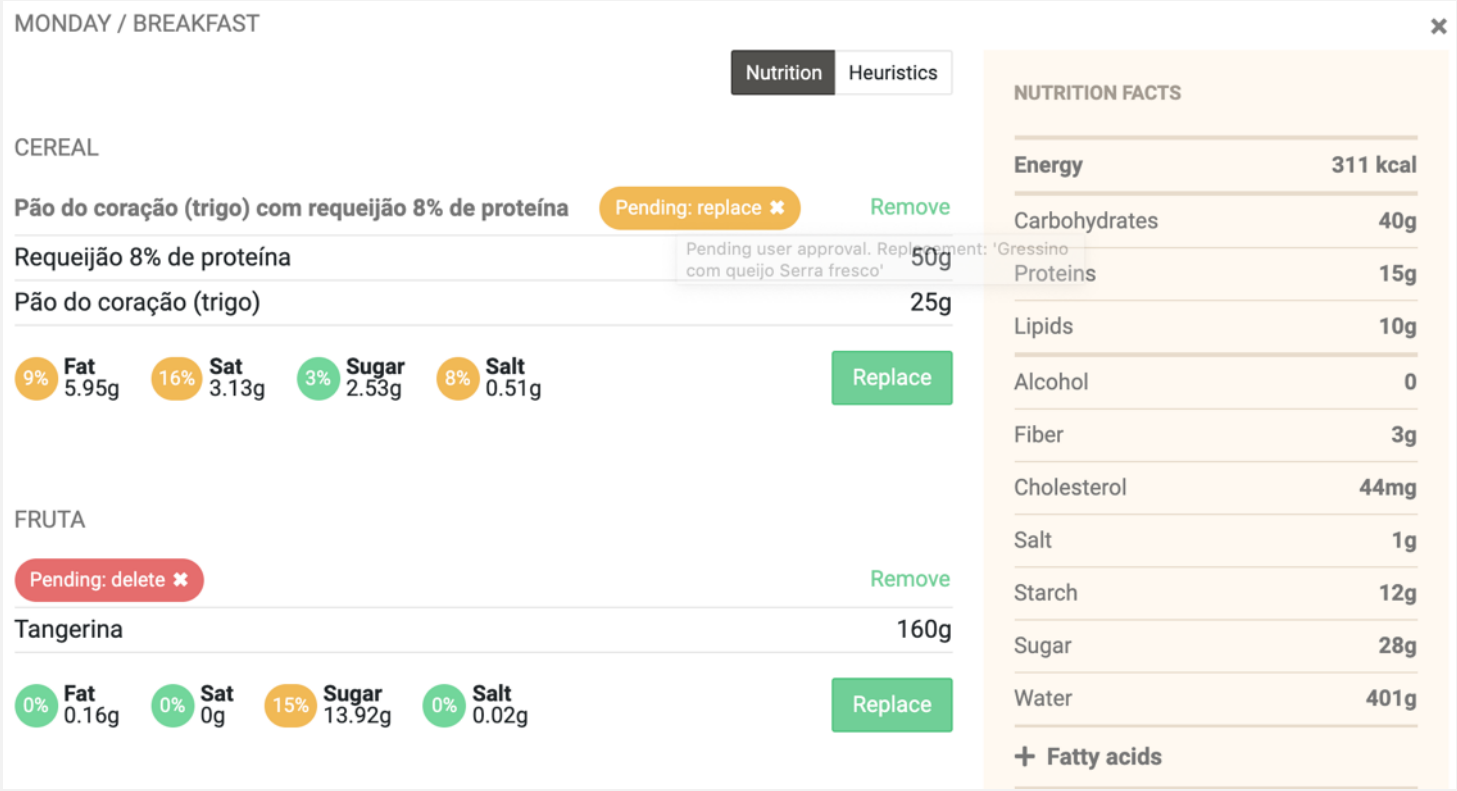
- Shop planning assistance
  - Planned meals needs
  - Purchase food products

- Flexibility
  - Add parts of the plan
  - Ingredients and products



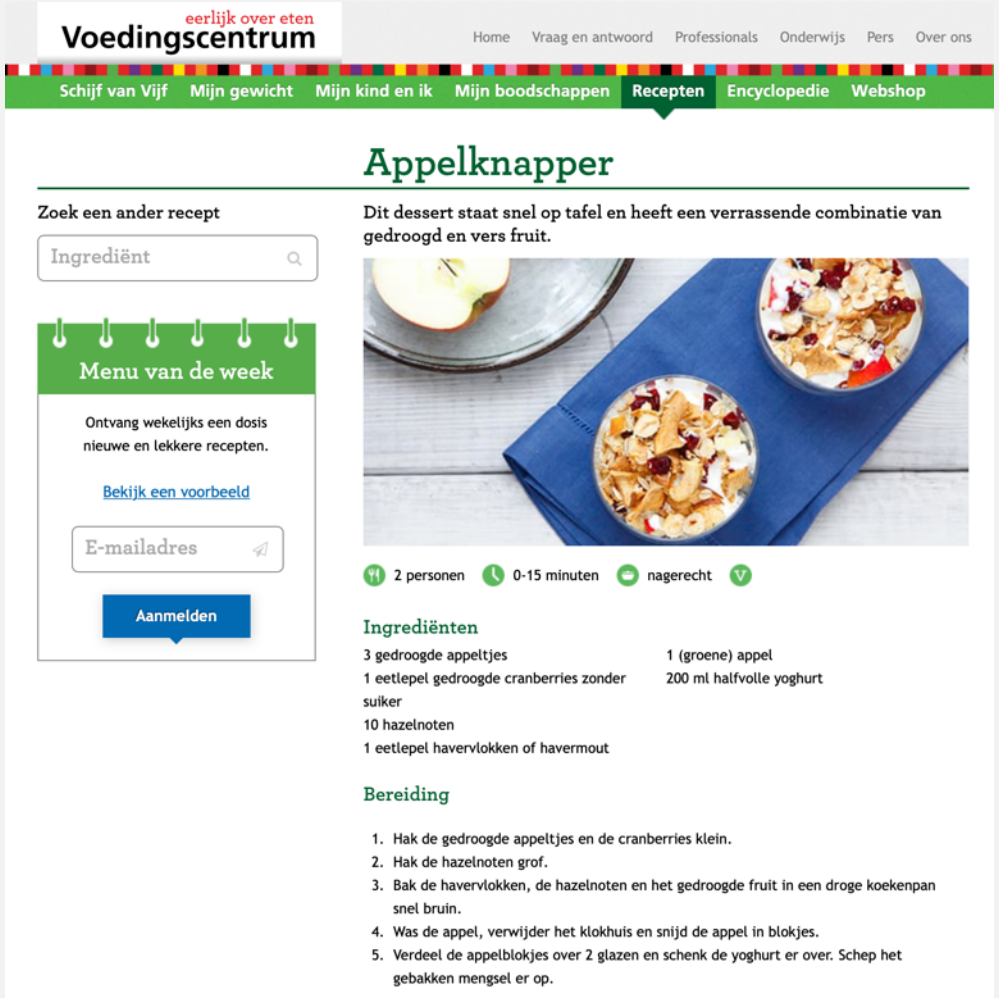
Clinical environment integration

- Dietitian
  - Support appointments
  - Create plans for clients
- Nutrition advisor
  - Supervise created meal plans
  - Suggest changes to plan
  - User able to accept or reject them
  - Tele-consultation and -nutrition



Integration of recipe content

1. Retrieve recipes from Web
2. Parse list of ingredients
3. Find matching food products in FCDB
4. Convert kitchen units to grams
5. Apply weight yield and nutrient retention factors



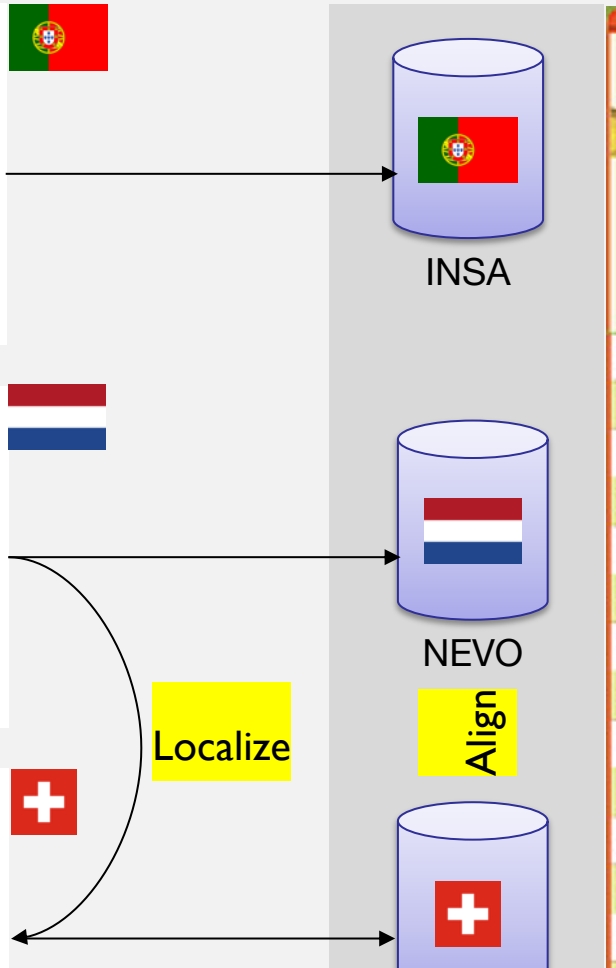
Voedingscentrum.nl

National recipe databases for field trials

Arroz de polvo

Prei met geitenkaas en linzen

Lachs mit Gemüse und Bulgur



	Serving Size	Calories	Total Fat (g)	Saturated Fat (g)	Cholesterol (mg)	Sodium (mg)
BALSAMIC	2 1 oz cont	195	20.74	2.86	0	228.54
BLUE CHEESE	2 1 oz cont	156	13.21	3.48	15.42	361
RANCH	2 1 oz cont	157	12.89	2.05	11	388
CAESAR	2 1 oz cont	346	37.79	3.42	2.52	332
HONEY MUSTARD	2 1 oz cont	306	31.28	4.8	13.8	295
ITALIAN (LOW CAL.)	2 1 oz cont	20	0	0		1000
LEMON HERB	2 1 oz cont	197	17.97	2.59	9.77	338
FAT FREE RASPBERRY	2 1 oz cont	60	0	0	0	540
ORIENTAL	2 1 oz cont	59	0	0	0	1156
PLAIN BALSAMIC	2 1 oz cont	40	0	0	0	0
OLIVE OIL	2 1 oz cont	480	56	4	0	0
FAT FREE RANCH	2 1 oz cont	50	0	0	0	560
1000 ISLAND	2 1 oz cont	240	24	5	10	420
SALSA	2 1 oz cont	22	0.48	0.24	1125	132.27
CILLANTRO	2 1 oz cont	114	12.24	1.8	0.8	89.4
SOUR CREAM	2 1 oz cont	121	11.9	7.4	25	30

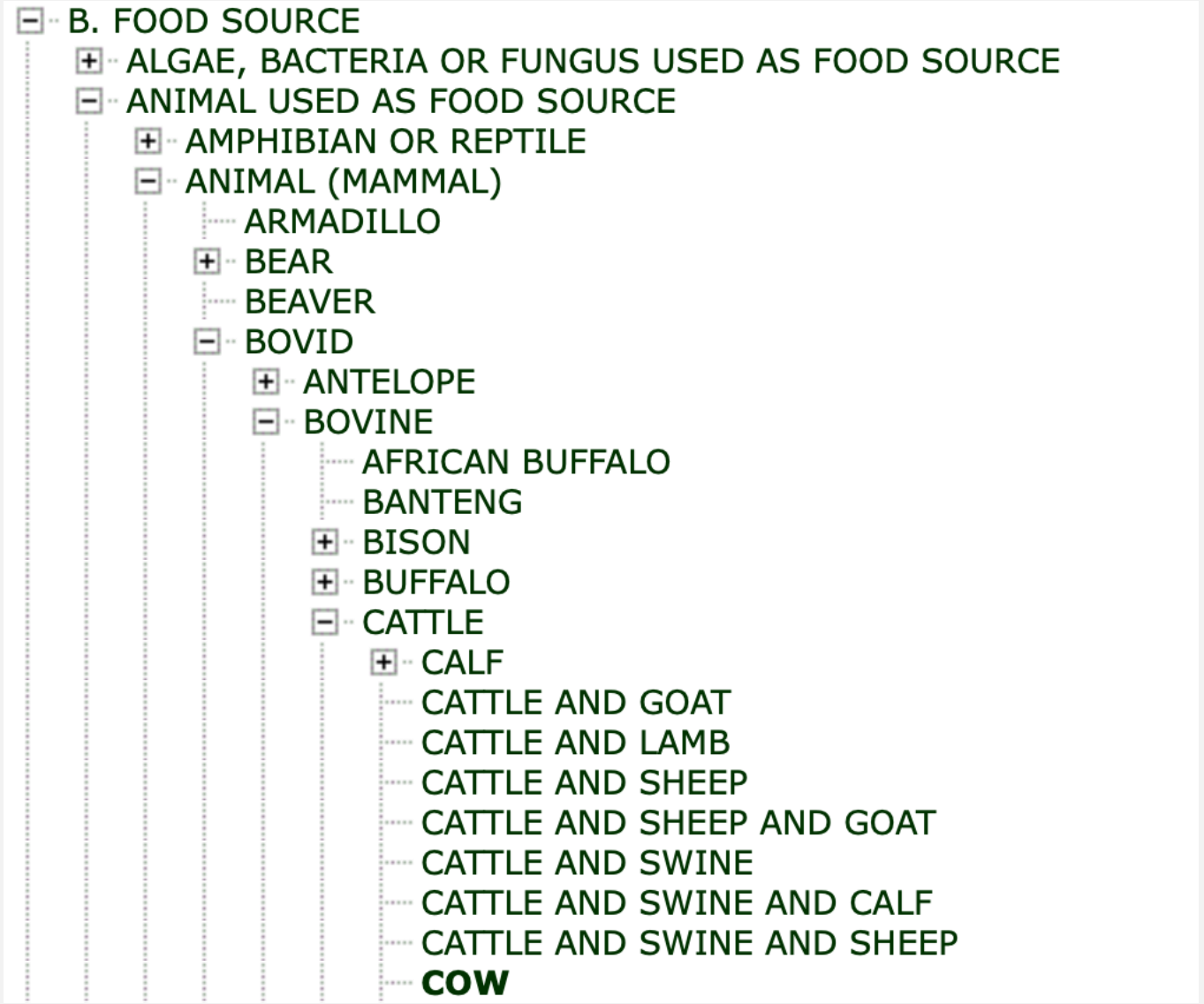
Source: EuroFIR

Langua a**L**imentaria facets

- Different facets describe different aspects of a food:
  - Facet A: PRODUCT TYPE
  - Facet B: FOOD SOURCE
  - Facet C: PART OF PLANT OR ANIMAL
  - Facet E: PHYSICAL STATE, SHAPE OR FORM
  - Facet F: EXTENT OF HEAT TREATMENT
  - Facet G: COOKING METHOD
  - Facet H: TREATMENT APPLIED
  - Facet J: PRESERVATION METHOD
  - Facet K: PACKING MEDIUM
  - Facet M: CONTAINER OR WRAPPING
  - Facet N: FOOD CONTACT SURFACE
  - Facet P: CONSUMER GROUP/DIETARY USE/LABEL CLAIM
  - Facet R: GEOGRAPHIC PLACES AND REGIONS
  - Facet Z: ADJUNCT CHARACTERISTICS OF FOOD

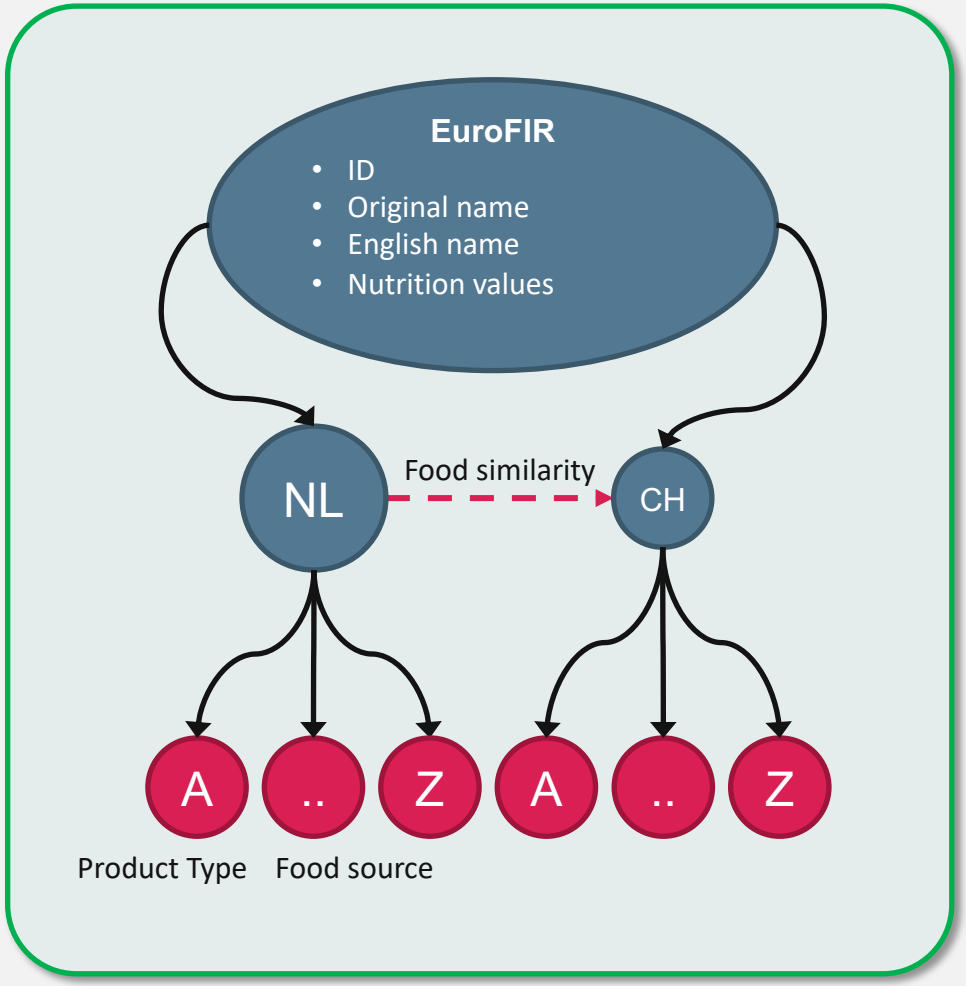
Facet B – FOOD SOURCE

- **ALGAE**
- **ANIMAL**
- **PLANT**
- **CHEMICAL**
- **LIQUID**



Alignment between national FCDBs

- Our aim is to automatically create the missing links between national Food Composition Databases by computing a hybrid syntactic and semantic similarity measure
  - Words in English food names
  - Sets of LanguaL terms that describe foods



Food matching NL – CH EuroFIR

"Yoghurt low fat w fruit" (from NL)

vs

"Yogurt with fruit, low fat, with sweetener" (from CH)

LanguaLID	LanguaLlabel
"A0721"	"31 OTHER MILK PRODUCTS (EFG)"
"A0783"	"FERMENTED MILK PRODUCT (EUROFIR)"
B1201	**"COW"**
"C0235"	"MILK"
E0103	**"SEMILIQUID"**
"F0018"	"PARTIALLY HEAT-TREATED"
"G0003"	"COOKING METHOD NOT APPLICABLE"
"H0101"	"LACTIC ACID FERMENTED"
"H0117"	"FLAVORING OR TASTE INGREDIENT ADDED"
"H0147"	"FRUIT ADDED"
"H0150"	"COLOR ADDED"
"H0158"	"SUCROSE ADDED"
"H0247"	"FAT PARTIALLY REMOVED"
"H0306"	"HOMOGENIZED OR EMULSIFIED"
"H0325"	"FAT PARTIALLY REMOVED, LESS THAN 50% REMAINING"
"J0131"	"PRESERVED BY CHILLING"
"J0135"	"PASTEURIZED BY HEAT"
"K0003"	"NO PACKING MEDIUM USED"
"M0001"	"CONTAINER OR WRAPPING NOT KNOWN"
"N0001"	"FOOD CONTACT SURFACE NOT KNOWN"
"P0024"	"HUMAN CONSUMER, NO AGE SPECIFICATION"
"R0001"	"GEOGRAPHIC PLACE OR REGION NOT KNOWN"
"Z0001"	"ADJUNCT CHARACTERISTICS OF FOOD NOT KNOWN"

B1201 COW
E0103 SEMILIQUID

=
?

LanguaLID	LanguaLlabel
"A0101"	"CULTURED MILK PRODUCT (US CFR)"
"A0783"	"FERMENTED MILK PRODUCT (EUROFIR)"
B1201	**"COW"**
"C0235"	"MILK"
E0110	**"SEMILIQUID WITH SOLID PIECES"**
"F0018"	"PARTIALLY HEAT-TREATED"
"G0003"	"COOKING METHOD NOT APPLICABLE"
"H0101"	"LACTIC ACID FERMENTED"
"H0108"	"NONNUTRITIVE SWEETENER ADDED"
"H0147"	"FRUIT ADDED"
"J0131"	"PRESERVED BY CHILLING"
"J0135"	"PASTEURIZED BY HEAT"
"K0003"	"NO PACKING MEDIUM USED"
"M0184"	"PLASTIC CONTAINER, RIGID OR SEMIRIGID"
"N0001"	"FOOD CONTACT SURFACE NOT KNOWN"
"P0024"	"HUMAN CONSUMER, NO AGE SPECIFICATION"
"P0040"	"REDUCED FAT FOOD"
"R0188"	"SWITZERLAND"
"Z0112"	"FOOD INDUSTRY PREPARED"
"Z0181"	"FAT CONTENT < 1%"

Nutrient retention and weight yield factor

Estimate effects of applying cooking methods

- Weight yield
- Nutrient retention

Table 5 : Weight yield factors by cooking of meat based dishes
- beef, continuation -

Kind of food, dish	Raw product	coo-king	Core Tempe-rature °C	Yield factor: with waste ($d_{(k,p)}$) $\bar{x}$	±	Yield factor: edible part ($e_{(k,p)}$) $\bar{x}$	±	n
Pot roast beef [1] (chuck, leg, shoulder), with gravy	FR m.Z	e/s	~ 90	-	-	1.08	0.05	3
- , meat part, well done				-	-	0.48	0.05	3
- , juice part				-	-	0.60	0.04	3
Rumpsteak [2] (chop, rump), medium	FR m.S	d	66-75	0.78	0.02	0.65	0.02	3
Rumpsteak [2] (chop, rump), well done	FR m.S	d	~ 90	0.73	0.02	0.60	0.02	3
Roast beef [1] (sirloin), rare	FR m.F	e/g	55-65	-	-	0.83	0.03	3
Roast beef [1] (sirloin), medium	FR m.F	e/g	66-75	-	-	0.75	0.04	9
Roast beef [1] (sirloin), well done	FR m.F	e/g	76-85	-	-	0.69	0.03	2
Pot roast beef [2] (sirloin), with gravy, medium	FR m.Z	d/s	66-75	-	-	0.99	-	1
- , meat part				-	-	0.45	-	1
- , gravy part				-	-	0.45	-	1
Pot roast beef [2] (sirloin), with gravy, well done	FR m.Z	d/s	76-85	-	-	0.87	-	1
- , meat part				-	-	0.42	-	1
- , gravy part				-	-	0.45	-	1
Steak [2] (beef, chuck, shoulder, sirloin), rare	FR m. F	d	55-65	-	-	0.82	-	1
Steak [2] (beef, chuck, shoulder, sirloin), medium	FR m.F	d	66-75	-	-	0.73	-	1
Steak [2] (beef, chuck, shoulder, sirloin), well done	FR m.F	d	76-85	-	-	0.63	-	1
Beef [2] (chuck, shoulder), goulash	FR m.Z	s	~ 90	-	-	0.73	0.02	3
- , meat part				-	-	0.35	0.02	3
- , sauce part				-	-	0.38	0.02	3
Beef olive [2] (top round), with gravy	FR m.Z	s	~ 90	-	-	0.94	0.02	3
- , meat part				-	-	0.47	0.02	3
- , gravy part				-	-	0.47	0.02	3
Spiced vinegar marinated beef [2] (chuck), with gravy	FR m.Z	s	~ 90	-	-	0.79	0.02	3
- , meat part				-	-	0.29	0.02	3
- , gravy part				-	-	0.50	0.02	3

$\bar{x}$ = mean value of available data; ± = confidence interval (p = 0,05); - = not available or not known
n = number of available data; FR = fresh, raw; [1] = big piece (> 0.5 kg, high > 2.5 cm); [2] = small piece (20-500 g, high < 2.5 cm);
a = boil, pressure boil; b = steam, pressure steam; c = stew, pressure stew, microwave stew; d = fry in pan with fat; e = fry in oven (hot air); f = deep fry; g = grill, broil, barbecue; s = braise; m.Z = with ingredients , common German recipe;
o.Z = without any ingredients; m.S = with salt and spice; m.F = with ingredients and fat absorption, common German recipe

PDF → Structured Format

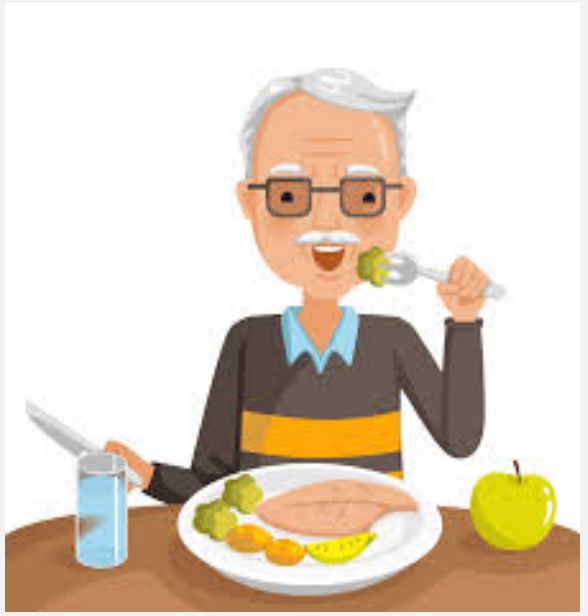
User Integration and Field Trials

1. Objectives & Introduction
2. Focus Groups
3. Field Trials & Design, NL & P
4. First Findings

1. Objectives

→ compliance & effectiveness of LIFANA solution

- technical acceptance & user friendliness
- improvements regarding dietary habits



- Providing personalized meal plan: size, weight, taste preferences, allergies, & diet restrictions
  - → Maintaining healthy BMI
  - → Targeting total calories
  - → Targeted protein intake
- Users with limited mobility: assistance with shopping, integrating informal caregivers
- Components: LIFANA app (Android & iOS), + GoLivePhone app. (GoLive Clip): activity level tracking & fall detection

2. Focus Groups & Outcomes

Aims of half-day sessions:

End-user integration, validating perceived utility & added value:

Output: application scenarios, personae, end-user requirements.

- In-depth-interviews participants
- 2 in-depth-interviews professionals
- Co-creation workshop

Speeddate
Mind maps / Collages
Discussion / Comments
Statements

α-version
- 3 iterations
  - 2 in PT
  - 1 in the NL
- 12 seniors

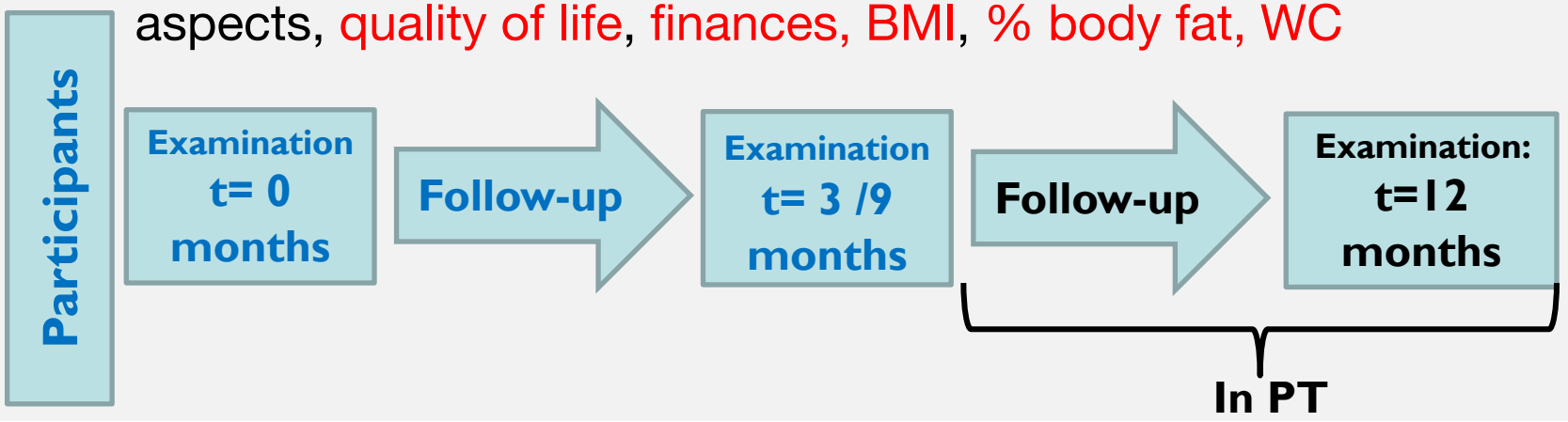
β-version
- 5 seniors in PT
- 5 seniors in NL

2. Focus Groups & Outcomes

- Different types of seniors: independent, no longer leave house & completely dependent.
- Health: more than healthy food. Healthy food: related to exercising & relationships
- Plenty of nutrition apps. Elderly: mostly own recipes & ingredients
- Eating: social event. But also elderly that are alone
- Technology: needs to be very simple
- Nutrition values & E-numbers: complicated & difficult to read. Better use points or icons/colours.
- Game elements: can make an app attractive
- Cultural differences for eating
- Need for app for nutritionists & clients: a digital app which monitoring protein intake (after hospitalization)

3. Field Trials & Design

- Duration: Mid-long term: 3 -12 months
- Inclusion: 65 - 85 y, free-living elderly. Exclusion: obese (BMI >30 kg/m^2), severe physical & mental handicaps.
- Measurements: interview at onset, after 3 months (NL, first (pilot) & second study) or after 9/12 months (P).
- Outcomes: A) perceived usefulness/satisfaction, reliability of technology, B) quality of recommendations, nutritional aspects, quality of life, finances, BMI, % body fat, WC



3. Field Trials & Design

Multivariate model:

Fixed Factors:
- ID (gender): Nested term
- Timepoint (onset, intermediate*/end – disregarding true length)
- Gender
- Gender x timepoint : Interaction (see if impact on 1 sex)

If non-normal distribution: Log-transformation

Dependent Parameters:
- BMI
- Waist-circumf.*
- Systolic BP*
- Diastolic BP*
- Hip-circumf.*
- Waist-Hip ratio*
- Body fat*
- Body water*
- Fat mass*

* Pt. In NL: all data self-reported

4. Results: NL

A. Results from pilot trial: 3-month follow-up:

Subjects recruited: 14
Subjects finalized: 9

B: Second 3-month trial: Subjects recruited: 140
Subjects finalized trial: 23

Type III Tests of Fixed Effects[a]

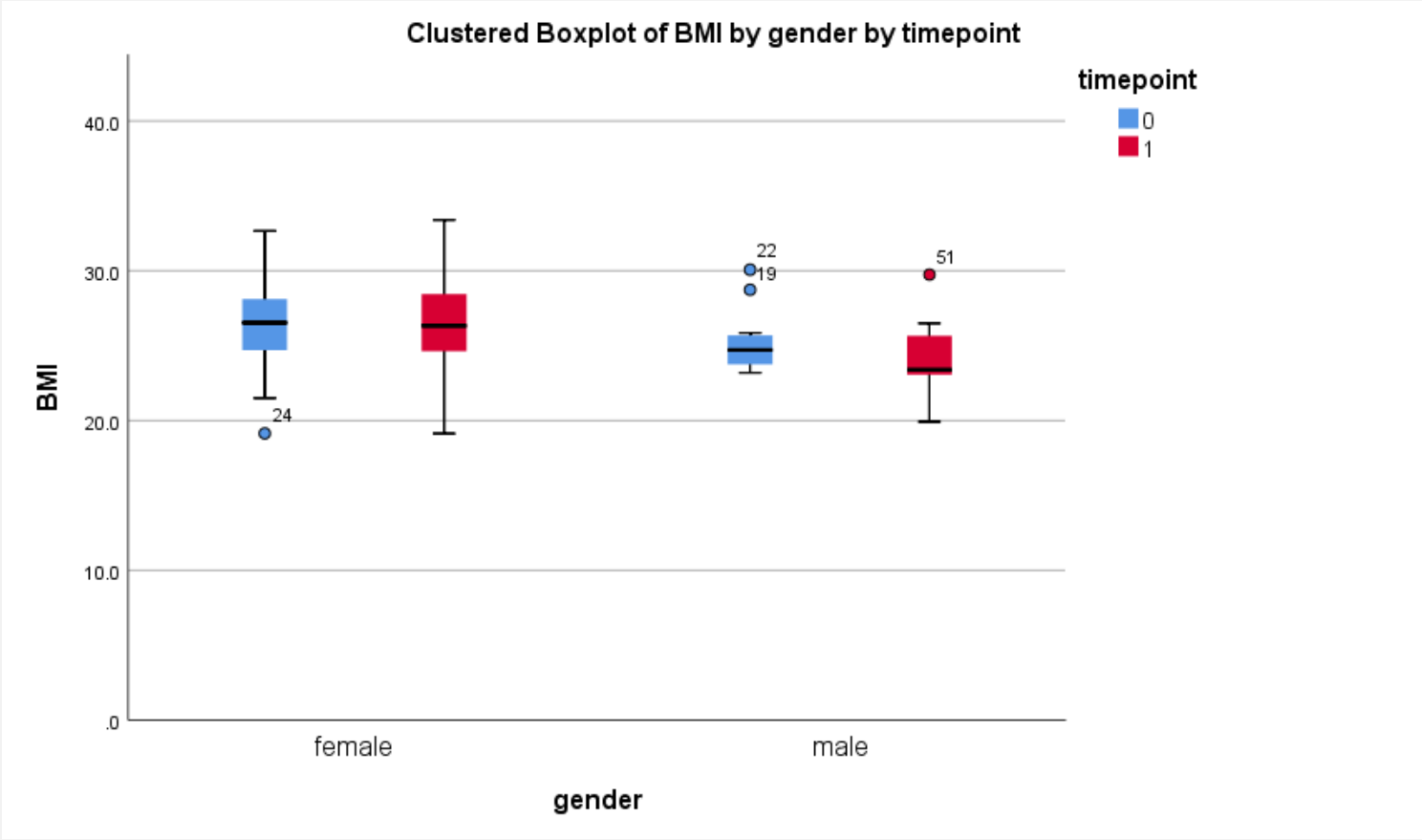
Source	Numerator df	Denominator df	F	Sig.
Intercept	1	30.000	324833.131	.000
timepoint	1	30	2.863	.101
ID(gender)	30	30	11.448	.000
gender	1	30	26.153	.000
timepoint * gender	1	30	3.519	.070

a. Dependent Variable: logBMI.

No sign. effect of time !

Trend for interaction
(stronger effect on males ?)

4. Results: NL – both studies



Change in BMI: -0.32 kg/m^2: not significant

4. Results: NL – second study

Questionnaires, testing T1 vs. T4

- comparison between month 0 vs. month 3
- 5 scales from high – fully agree to low- fully disagree

1. LiFANA will help me/helped me to improve my eating behavior
2. LiFANA will help me/helped me to make a better food planning
3. Will have/did't have many problems using LiFANA
4. Using LiFANA will improve/improved my weight
5. After using LiFANA more than 3 months I will know/know more about healthy food & exercise
5. I will certainly continue using LiFANA after the end of the trial

4. Results: NL – second study

Results from questionnaires :

Estimates

Dependent Variable	Timepepoint	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
T1 What are your expectations reg, LiFANA? It wil help improve my nutrition.	.00	2.478[a]	.127	2.214	2.743
	1.00	3.696[a]	.127	3.431	3.960
T1 It will help me to make better nutritional plans	.00	2.565[a]	.169	2.214	2.917
	1.00	3.435[a]	.169	3.083	3.786
T1 I won't have much problems with iFANA.	.00	2.217[a]	.190	1.823	2.612
	1.00	3.478[a]	.190	3.084	3.873
T1 By using LiFANA my body weight will improve.	.00	2.652[a]	.085	2.476	2.828
	1.00	3.609[a]	.085	3.433	3.785
T1 After 3 months of using liFANA I will know much more about how to eat healthy and excercise.	.00	2.609[a]	.177	2.240	2.977
	1.00	3.348[a]	.177	2.979	3.716
T1 After 3 months I will surely use the app.	.00	2.913[a]	.133	2.636	3.190
	1.00	3.826[a]	.133	3.549	4.103

a. Based on modified population marginal mean.

1: fully agree
2: agree
3: neither nor
4: disagree
5: fully disagree

Answers significantly deteriorated with time !

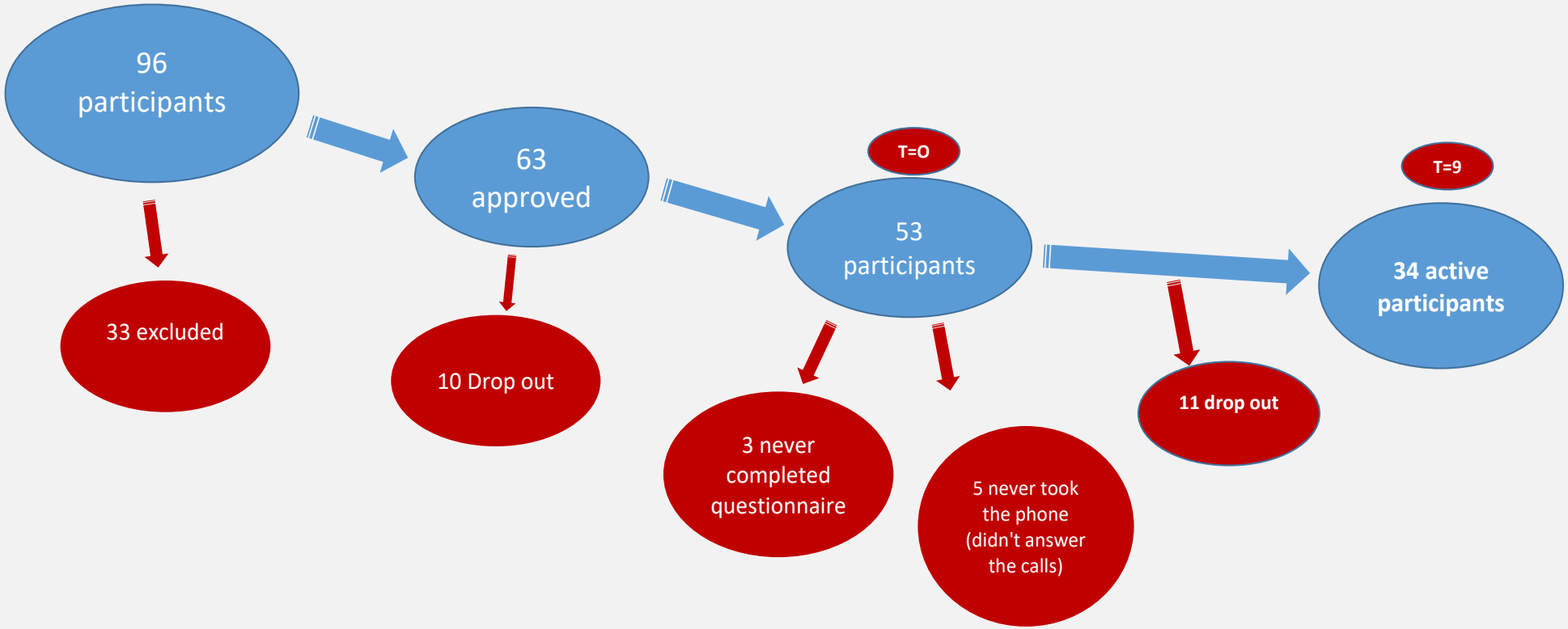
People more enthusiastic at onset !

Ca. 1 point mean increase

4. First Results: PT – biological endpoints

1 year:

Subjects recruited: 96
Subjects at T=9 months: 34



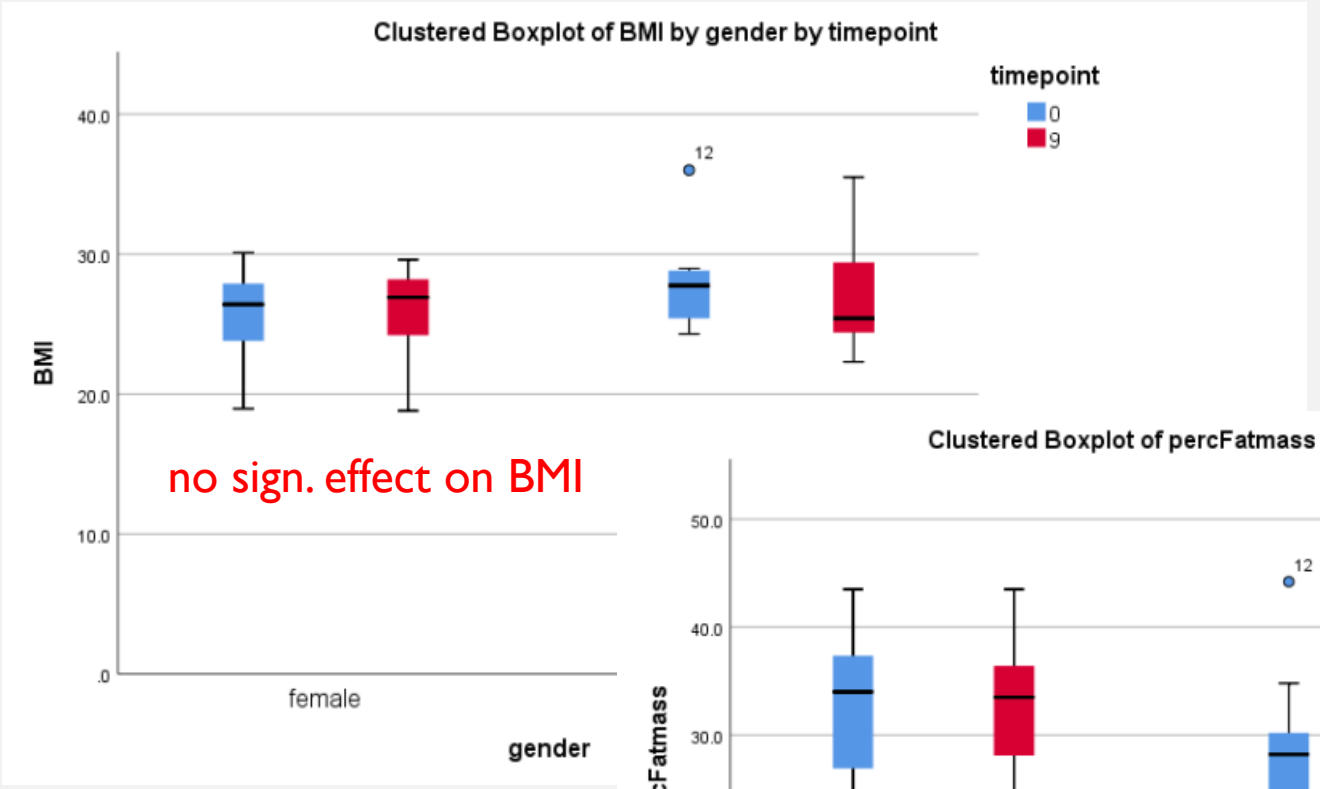
28 complete cases at T=9, with both time points

4. First Results: PT

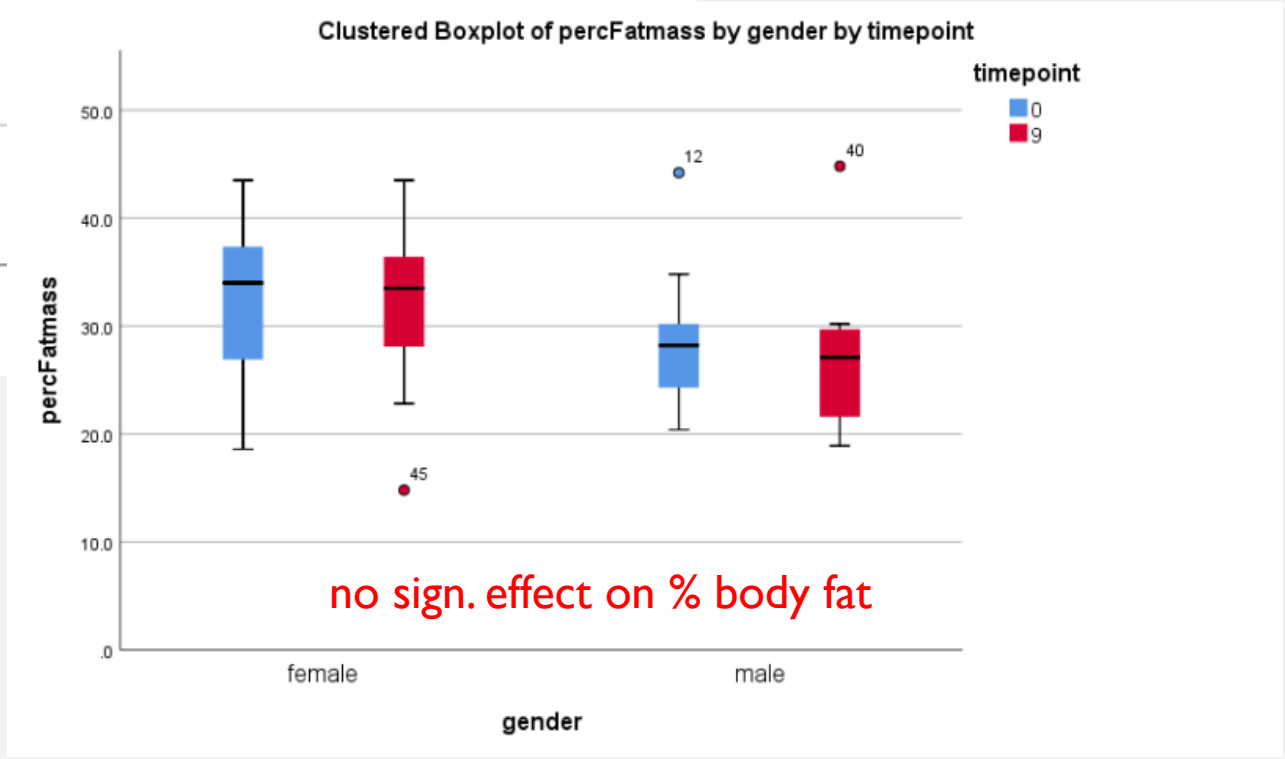
Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
timepoint	BW	.090	1	.090	.041	.841
	BMI	1.055	1	1.055	.933	.343
	WC	8.482	1	8.482	.316	.579
	HipC	209.088	1	209.088	10.933	.003
	WtoH	.031	1	.031	5.083	.033
	percFatmass	4.818	1	4.818	.731	.400
	percBodywat	7.540	1	7.540	1.483	.234
	SBP	74.564	1	74.564	.670	.420
	DBP	28.783	1	28.783	.626	.436
timepoint * gender	BW	.399	1	.399	.180	.675
	BMI	2.730	1	2.730	2.416	.132
	WC	57.339	1	57.339	2.133	.156
	HipC	44.802	1	44.802	2.343	.138
	WtoH	.017	1	.017	2.748	.109
	percFatmass	6.663	1	6.663	1.011	.324
	percBodywat	1.331	1	1.331	.262	.613
	SBP	865.564	1	865.564	7.782	.010
	DBP	.497	1	.497	.011	.918

4. First Results: PT

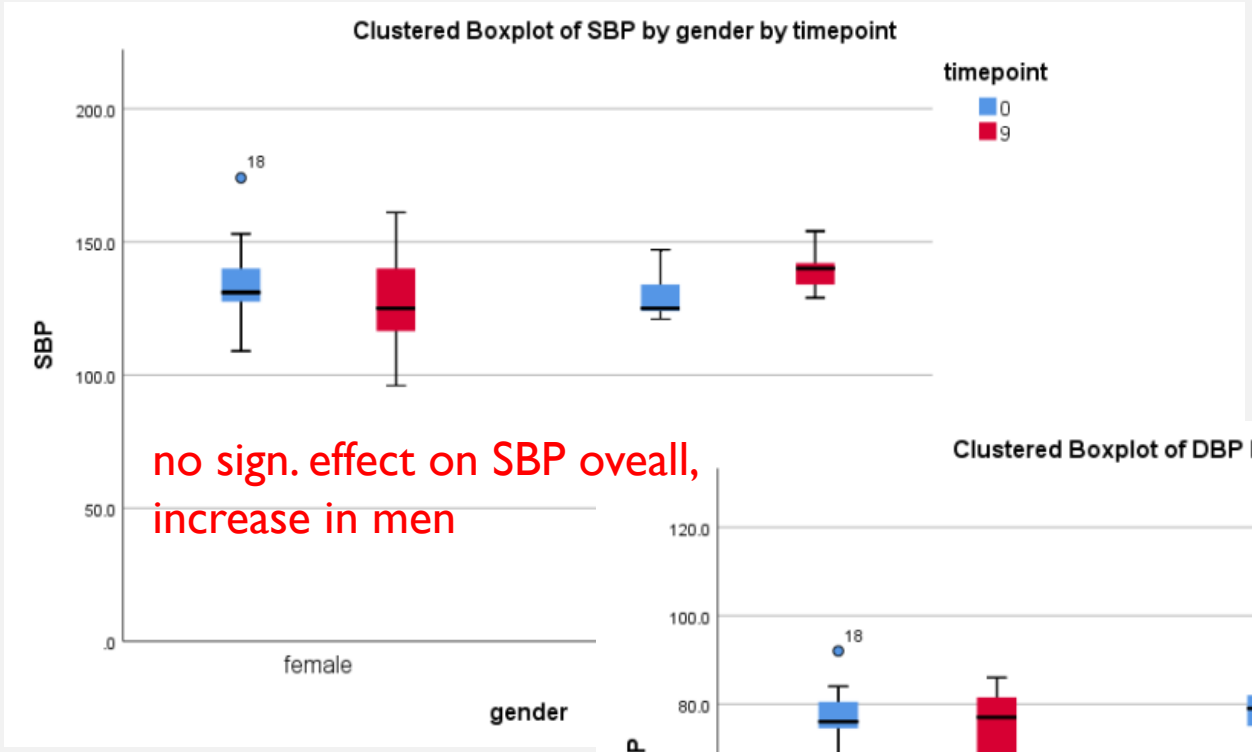


no sign. effect on BMI

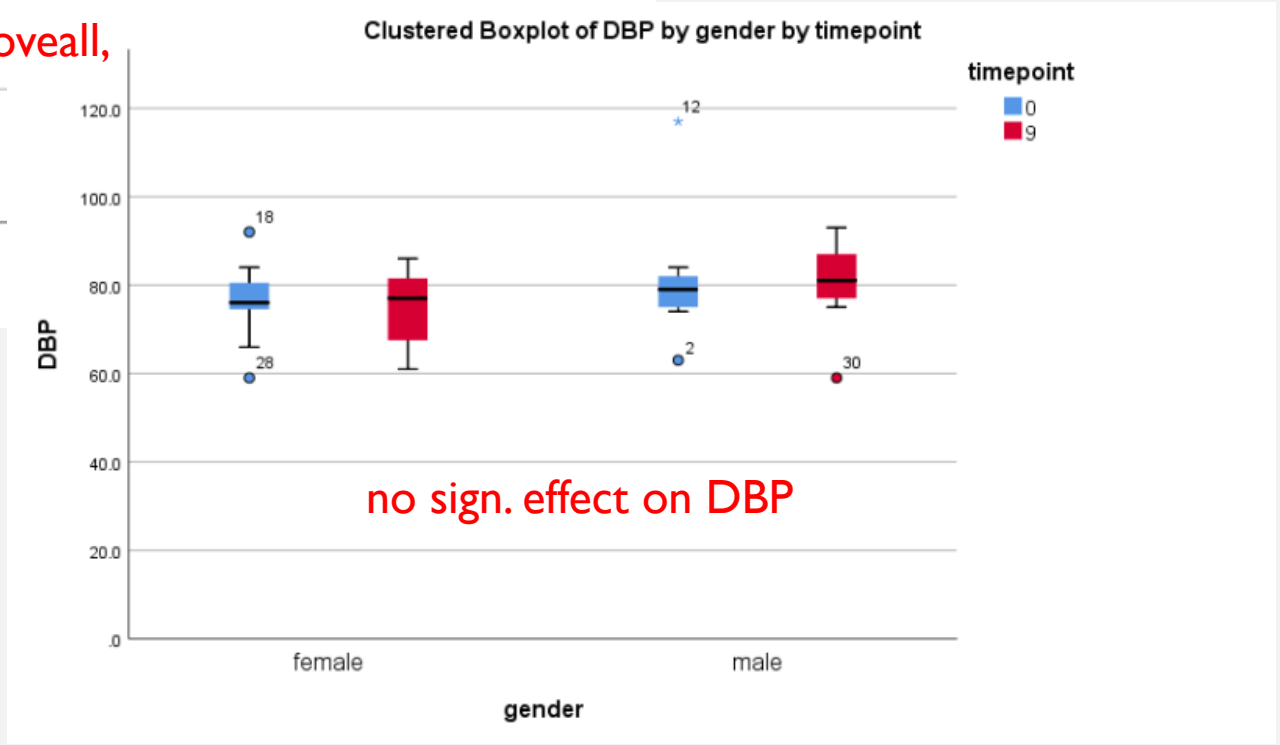


no sign. effect on % body fat

4. First Results: PT

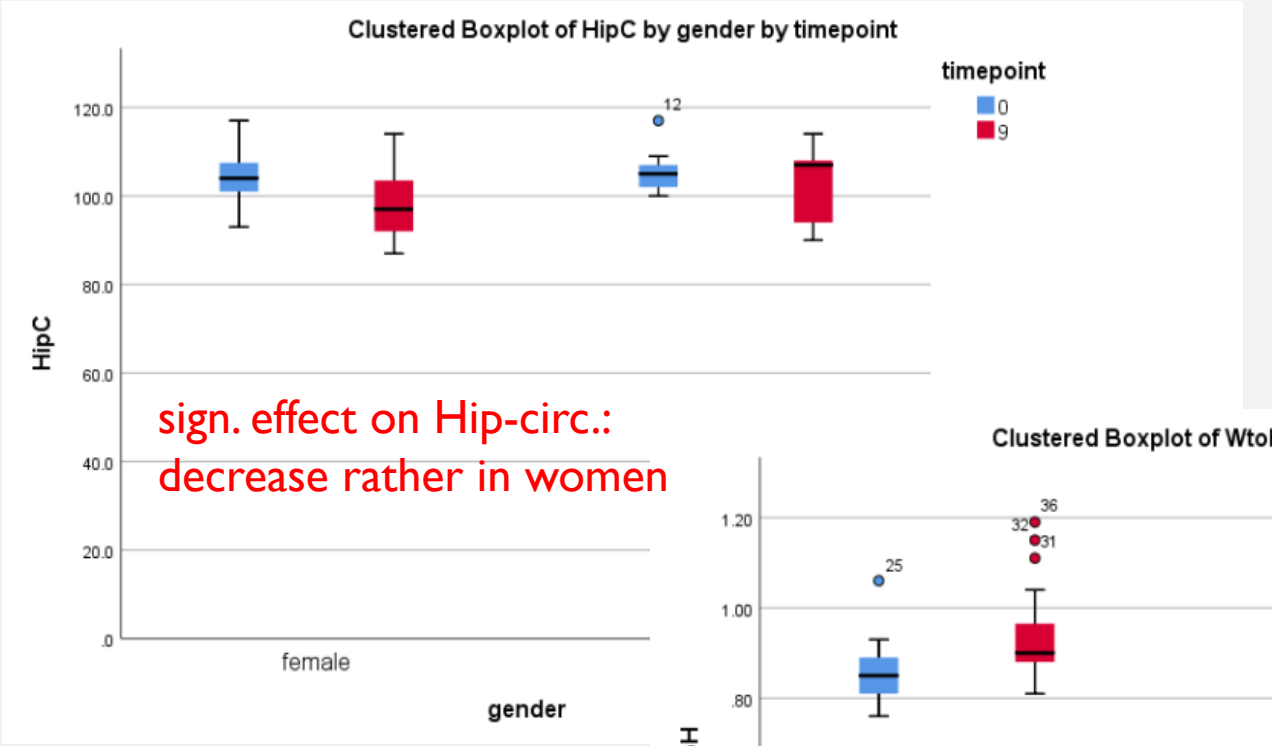


no sign. effect on SBP oveall, increase in men

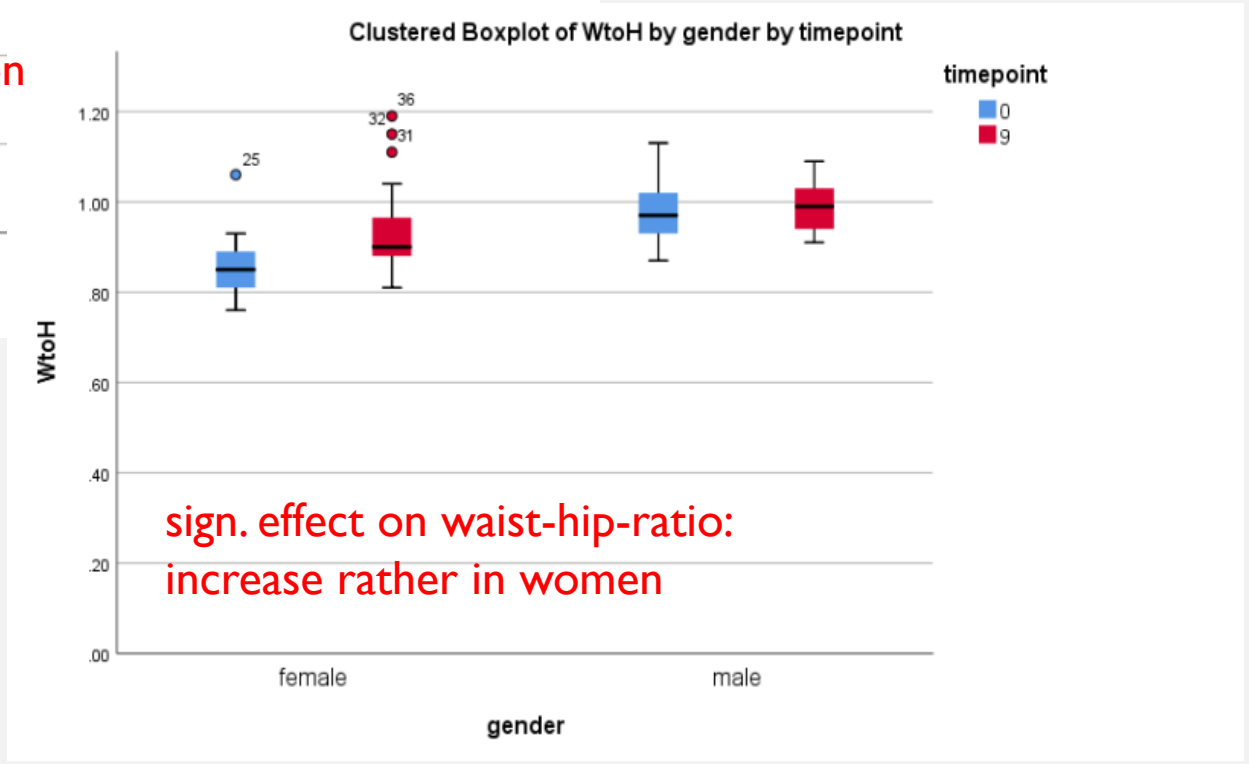


no sign. effect on DBP

4. First Results: PT

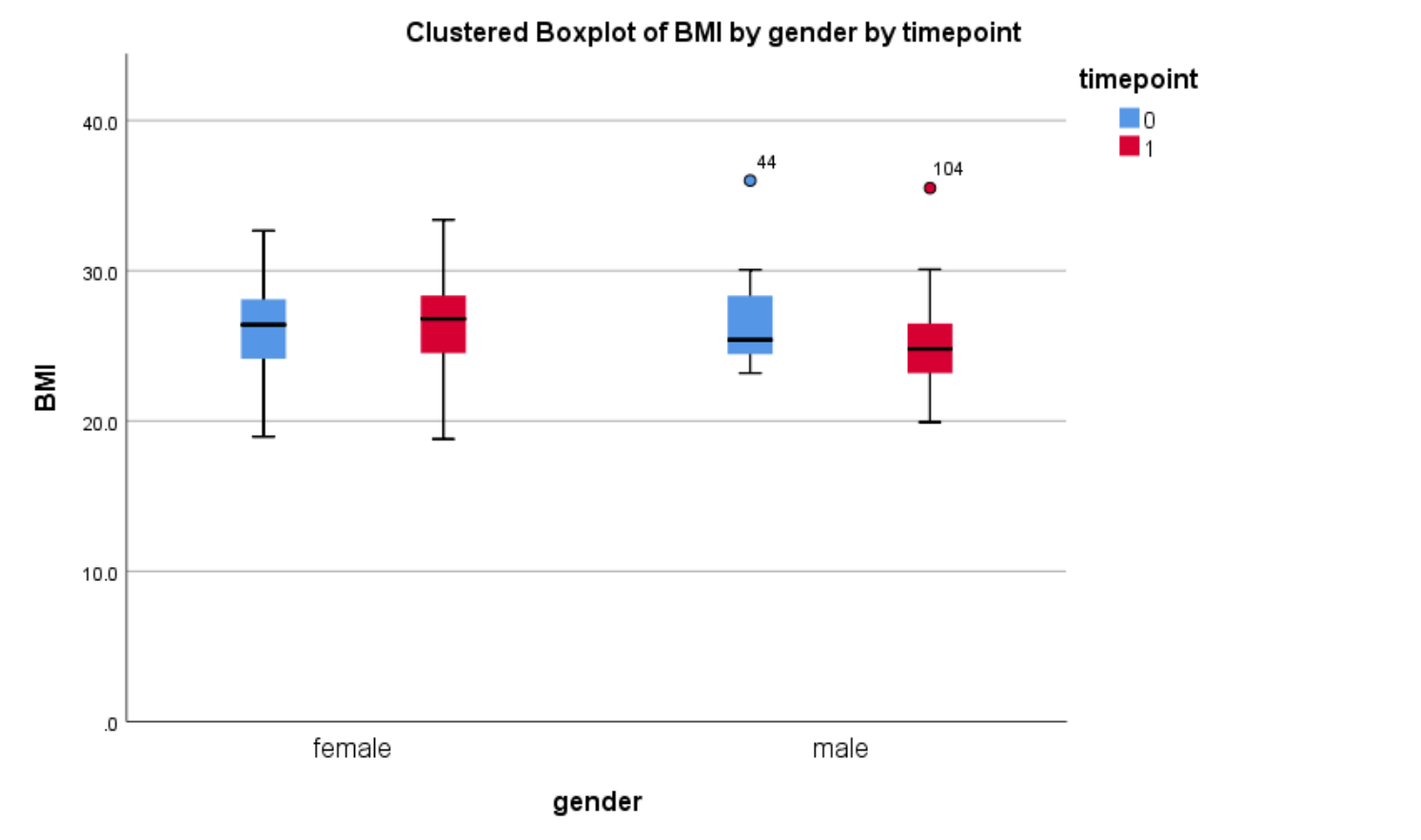


sign. effect on Hip-circ.:
decrease rather in women



sign. effect on waist-hip-ratio:
increase rather in women

4. Combined approach PT & NL



Pooled results from NL (23 + 9) plus PT (28):

- -0.2 BMI-units (kg/m^2) overall
- -0.9 BMI-units for men !
- +0.1 BMI-units for women

4. First Results: PT – Technology accept.

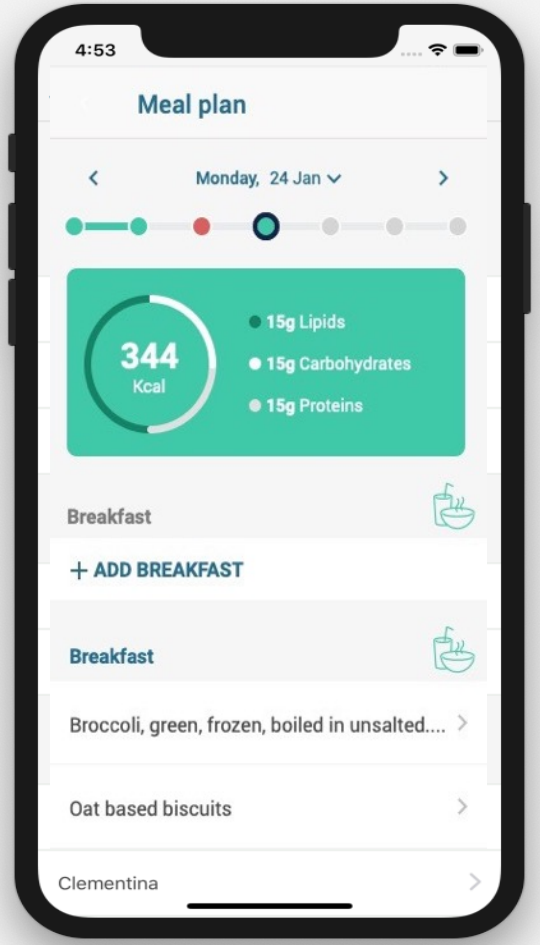
Main feedback of participants t=9

- Repetition of suggested dishes
- Sometimes not possible to exchange some products for others
- Heavy meals at dinner (roasted meat, roasted fish)
- Breakfast doesn't respect tradition (e.g. bread with butter or sweet and coffee with milk; instead the app suggests bread with cream cheese & other less conventional products)
- App should recommend fruit juice for main meals
- Sometimes restricted products appear in the suggestions

What makes LIFANA unique

PERSONAL	Highly personalized meal plans take into account needs, food restrictions, and lifestyle.
CONVENIENT	Meal plans don't require any food logging efforts from users.
CULTURAL	Country-specific meals and food composition databases.
EXHAUSTIVE	All macro- and micro-nutrients are available for professionals.
TRACEABLE	The source of all nutritional information is traceable.
SOA	Service Oriented Architecture supports integration in various business models.

Thank you

- Questions?

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