

# Associations between food groups and eating time slots by diabetes status in UK adults

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# Conflit of Interest disclosure

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We have no, real or perceived, direct or indirect conflicts of interest that relate to this presentation.

# Background & Objectives

- Eating late/having a late dinner was found to be related with higher risk of obesity, hyperglycemia, metabolic syndrome, and diabetes.
- The relationship between food choice and their time of consumption is still largely unknown.
- Identify those unhealthy foods which might be chosen during night time would be helpful.
- To investigate and describe the relationships between **food** eaten by British adults, **time slots** and **type 2 diabetes (DM)**.

# Data Source - the NDNS RP

- NDNS RP (started from 2008):
  - On-going cross-sectional study
  - representative of UK population  
about 1000/year
  - 4 consecutive days food diary
- 6802 adults (age  $\geq$  19 years)
  - 2810 men and 3992 women;
  - 749,026 recordings of food group entries.

# Methods and strategies

- Correspondence analysis (CA)
  - Biplots in total sample and stratified by DM status
- Logistic regression models using generalized estimating equation (GEE).
- Generate hypotheses from (randomly selected) 50% of the food recordings then test using the other half.
- Time slots defined:  
6-9 am, 9-12 noon, 12-2 pm, 2-5 pm, 5-8 pm,  
8-10 pm and 10 pm-6 am.

# An one-day example of the food diary

Day: Thurs		Date: 31st March					
Time	Where? With Whom? TV on? At table?	Food/Drink description & preparation	Brand Name	Portion size or quantity eaten			
<b>How to describe what you had and how much you had can be found on pages 16 - 21</b>							
<b>6am to 9am</b>							
6.30 am	Kitchen Alone No TV Not at table	Filter coffee, decaffeinated milk (fresh, semi-skimmed) Sugar white	Douwe Egberts  Silverspoon	Mug A little 1 level tsp			
7.30 am	Kitchen Partner TV on At table	Filter coffee with milk and sugar Cornflakes Milk (fresh, semi-skimmed) Toast, granary medium sliced Light spread Marmalade	As above  Tesco's own  Hovis Flora Hartleys	As above 1b drowned 1 slice med spread 1 heaped tsp			
<b>9am to 12 noon</b>							
10.15 am	Office desk Alone No TV Not at table	Instant coffee, not decaffeinated Milk (fresh, whole) Sugar brown	Kenco	Mug A little 1 level tsp			
11 am	Office desk Alone No TV Not at table	Digestive biscuit – chocolate coated on one side	McVities	2			

Time	Where? With Whom? TV on? At table?	Food/Drink description & preparation	Brand Name	Portion size or quantity eaten
<b>12 noon to 2pm</b>				
12.30 pm	Tea room at work Colleagues No TV At table	<p>Ham salad sandwich from home Bread, wholemeal, thick sliced Light spread</p> <p>Low fat Mayonnaise Smoked ham thinly sliced Lettuce, iceberg Cucumber with skin</p> <p>Unsweetened orange juice from canteen</p> <p>Apple with skin from home, Braeburn</p>	<p>Tesco's own Flora</p> <p>Hellmans Tesco's own</p> <p>Tropicana</p>	<p>2 slices thin spread on 1 slice</p> <p>2 teaspoons 2 slices 1 leaf 4 thin slices</p> <p>250ml carton</p> <p>medium size, core left</p>
<b>2pm to 5pm</b>				
3 pm	Meeting room at work With supervisor No TV Not at table	Tea, decaffeinated Milk (fresh, whole) Jaffa cake – mini variety	Twinings Tesco's own McVities	Mug Some 6

Time	Where? With Whom? TV on? At table?	Food/Drink description & preparation	Brand Name	Portion size or quantity eaten
<b>5pm to 8pm</b>				
6.30 pm	Pub Partner TV on At table	Gin Tonic water diet Lager 3.8% alcohol Salted peanuts	Gordon's Schweppes Draught, Carlberg KP	Single measure 1/2 small glass 1 pint 1 handful
8 pm	Dining room Family No TV At table	Spaghetti, wholemeal Bolognese sauce (see recipe) Courgettes (fried in butter) Tinned peaches in juice (juice drained) Single cream UHT  Orange squash No Added Sugar	Tesco's own  Prince's  Sainsbury's own	3b 6 tablespoons 4 tablespoons 3 halves 1 tablespoon  200ml glass, 1 part squash, 3 parts tap water
<b>8pm to 10pm</b>				
9 pm	Sitting room Alone TV on Not at table	Grapes, green, seedless Chocolates, chocolate creams Potato crisps, Prawn Cocktail	Bendicks Walkers	15 2 25g bag (from multipack)
<b>10pm to 6am</b>				
10.30 pm	Bed room Partner No TV Not at table	Camomile tea (no milk or sugar)	Twinings	1 mug

# Definition of diabetes

DM Status	Self-reported	Glucose (mmol/L)		HbA1c (%)	n
Healthy	No	< 6.1	AND	< 6.5	2626
Pre-DM	No	6.1 ~ 6.99		--	133
Undiagnosed	No	$\geq 7.00$	OR	$\geq 6.5$	99
Diagnosed	Yes	--		--	227
Unknown	NA	NA		NA	3717

# Food groups and contribution to calories

link to full table: [http://wangcc.me/CA-NDNSRP\\_forDiscuss/#12\\_food\\_groups](http://wangcc.me/CA-NDNSRP_forDiscuss/#12_food_groups)

		Show <input type="button" value="6"/> entries	Search: <input type="text"/>		
	mfgLab	n	n.freq	cal.Prop	calcumprop
1	Pasta & Rice	18353	2.45%	7.36%	7.362%
2	White Bread	18434	2.46%	6.8%	14.166%
3	Chips	6749	0.9%	3.95%	18.116%
4	Cakes & Pastries	7806	1.04%	3.59%	21.701%
5	Veg not raw	51317	6.85%	3.49%	25.193%
6	Biscuits	13200	1.76%	3.49%	28.678%

Showing 1 to 6 of 60 entries

Previous

1

2

3

4

5

...

10

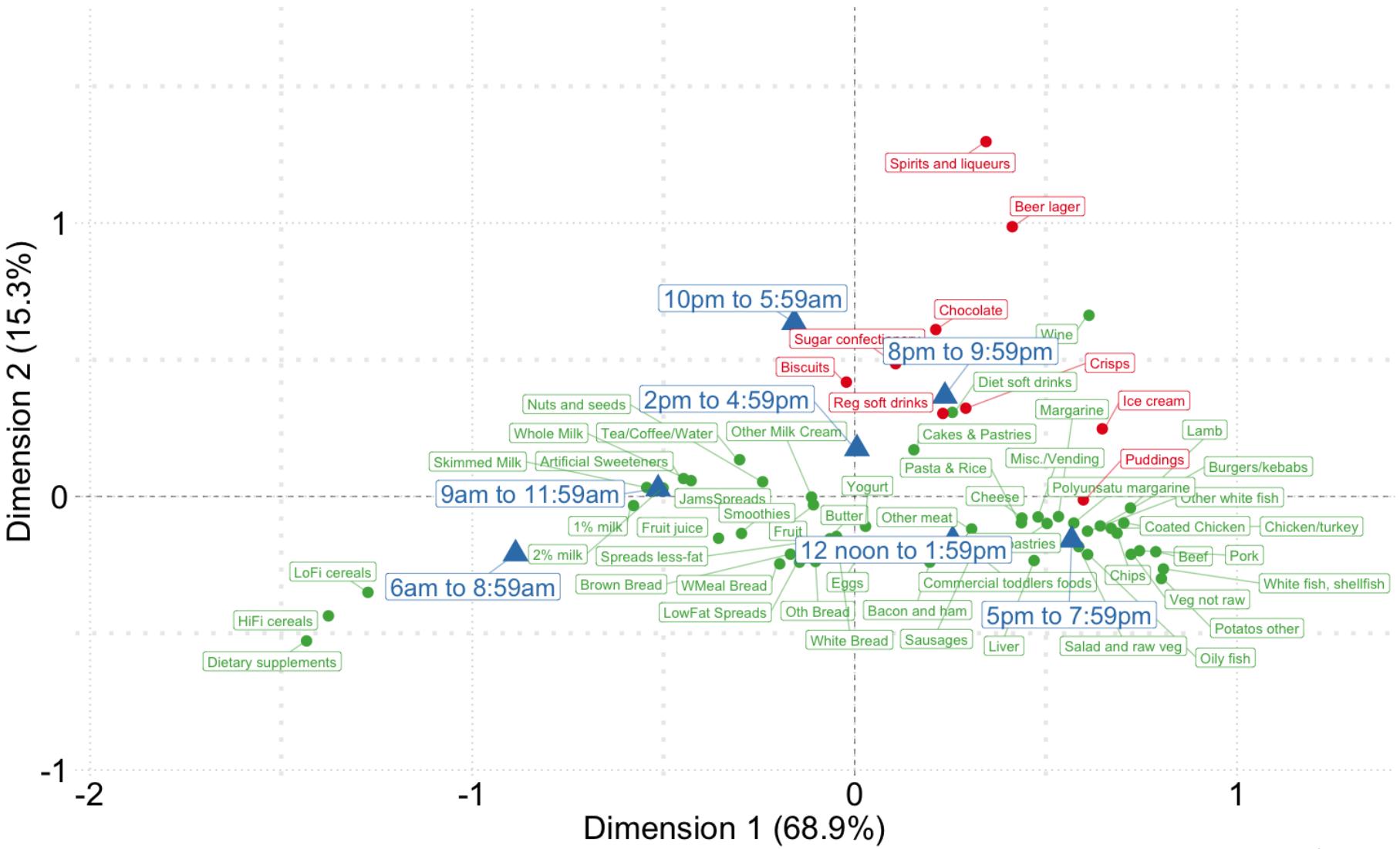
Next

# The full contingency table of food recordings and time slots

Show 5 entries		Search: <input type="text"/>						
		6am to 8:59am	9am to 11:59am	12 noon to 1:59pm	2pm to 4:59pm	5pm to 7:59pm	8pm to 9:59pm	10pm to 5:59am
1% milk		189	137	50	66	79	48	35
2% milk		7513	6844	3262	3986	3124	2530	1533
Artificial Sweeteners		920	832	467	591	410	337	219
Bacon and ham		209	757	1707	453	906	213	57
Beef		3	28	435	254	1462	306	38
Showing 1 to 5 of 60 entries		Previous		1	2	3	4	5
...		12		Next				

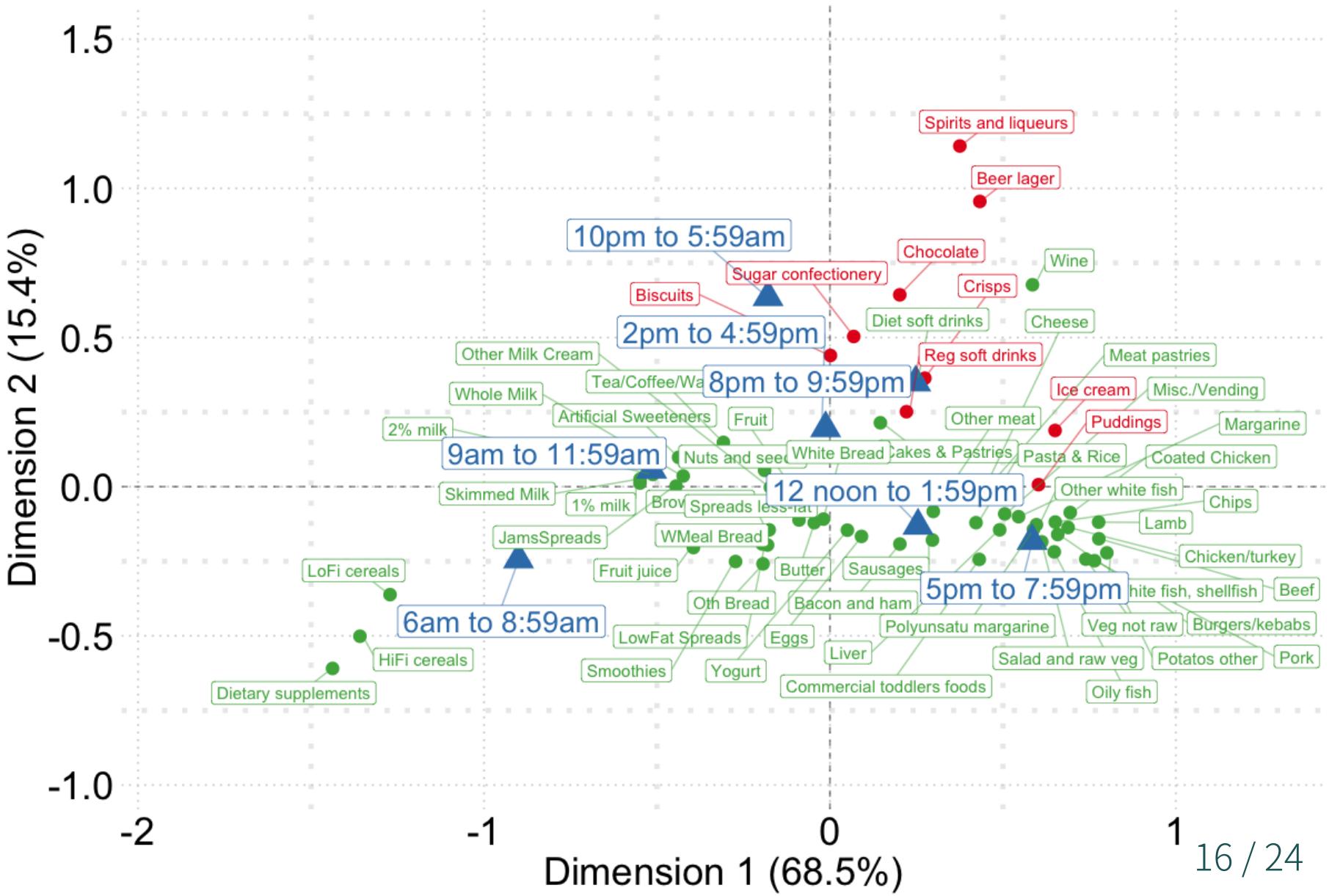
# CA biplots in total sample

# Correspondence Analysis of food groups and Time Slots in Total Sample

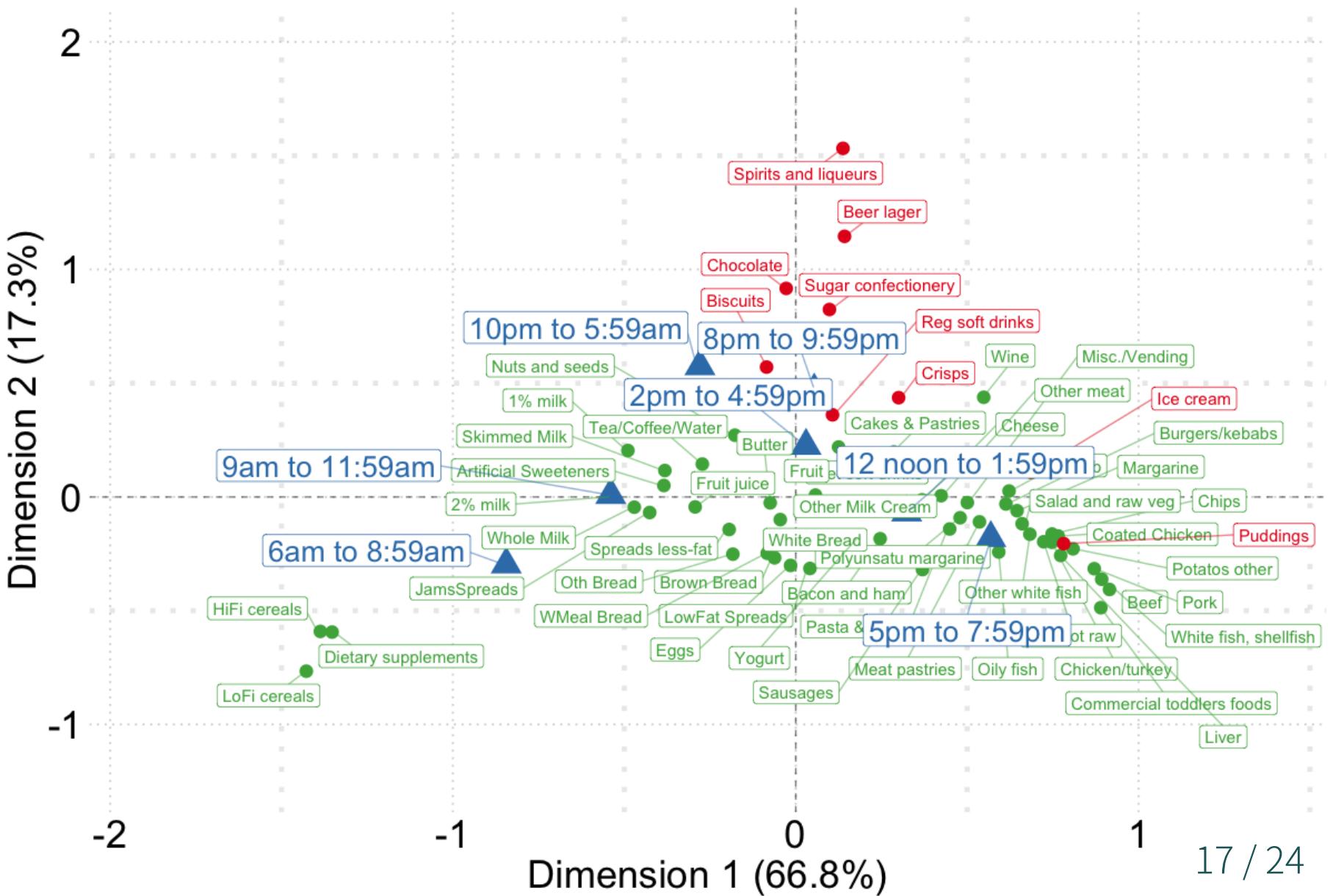


# Food group consumption and time slots stratified by DM status

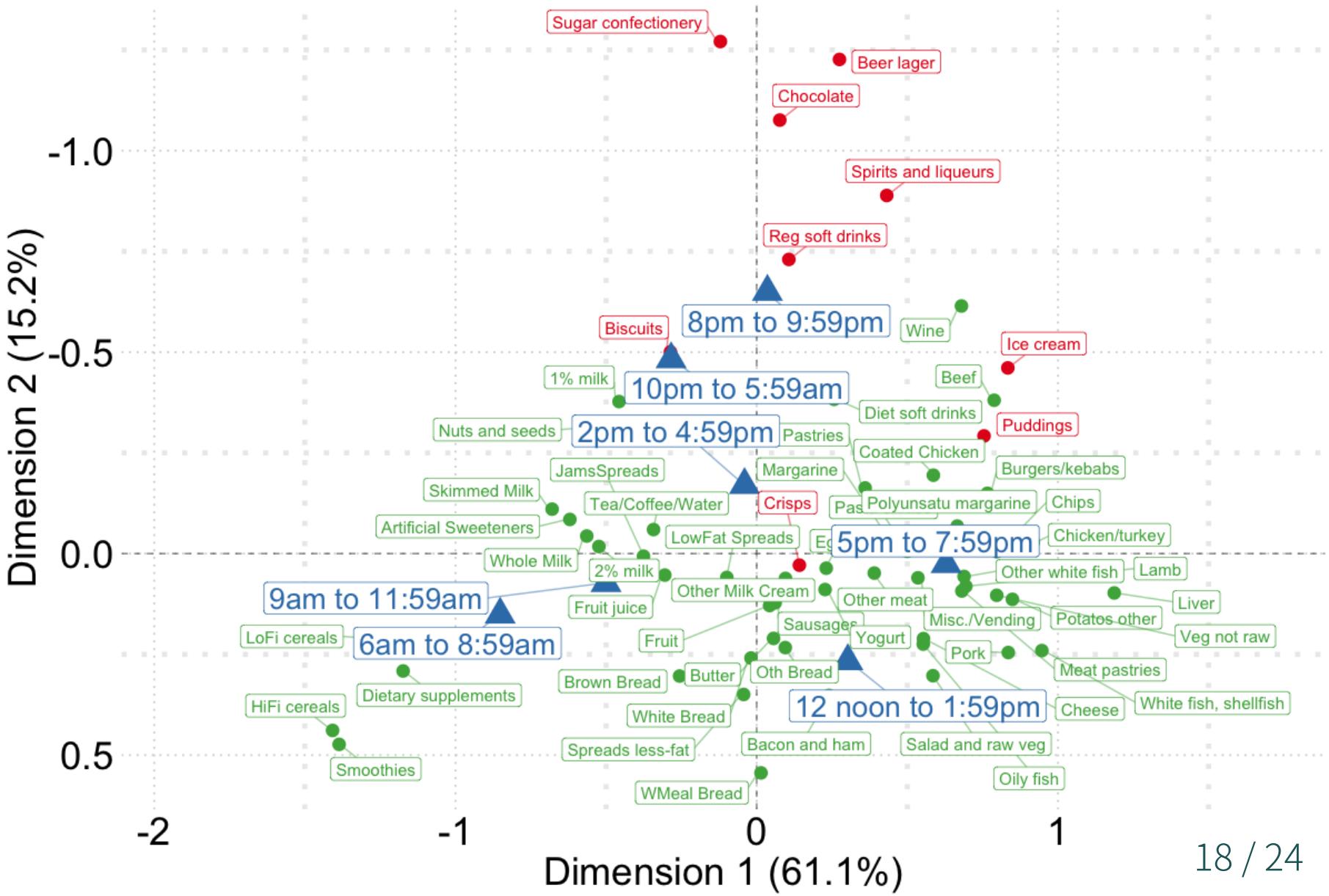
# Correspondence Analysis of food groups and Time Slots among Non-DM participants.



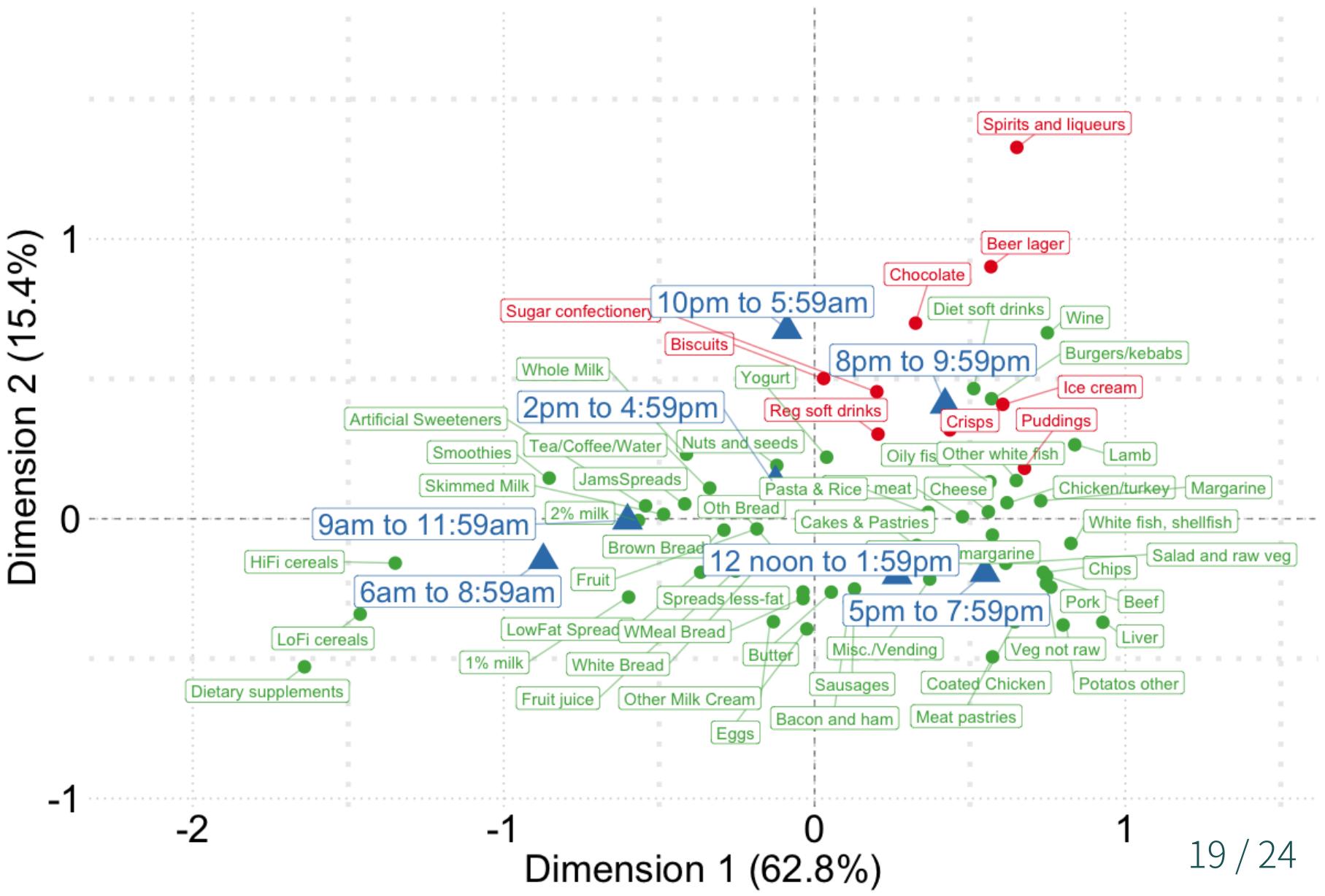
# Correspondence Analysis of food groups and Time Slots among DM patients



# Correspondence Analysis of food groups and Time Slots among Undiag-DM patients



# Correspondence Analysis of food groups and Time Slots among PreDM participants



# Summary

- Foods colored in red for further hypotheses testing as they are considered to be relatively unhealthy and possibly being consumed differently by DM status.
- Sugar confectioneries, regular soft drinks, chocolates appear much further at the top of the figures among those with undiagnosed DM compared to the others.

# OR (99% CI) for foods eaten at night (8pm - 6am) vs. earlier time, among total and according to DM status

Show 5 entries Search:

		H0	Overall	Healthy	Pre-DM	Undiag-DM	DM
1	Pudding		1.38 (1.03, 1.86)	1.50 (1.10, 2.07)	0.89 (0.16, 4.87)	1.81 (0.41, 7.98)	0.58 (0.14, 2.43)
2	Sweetened Soft drink		1.74 (1.47, 2.06)	1.72 (1.43, 2.06)	1.87 (0.97, 3.57)	2.72 (1.44, 5.14)	1.38 (0.65, 2.96)
3	Sugar Confectionery		1.92 (1.38, 2.69)	1.63 (1.14, 2.32)	2.10 (0.52, 8.46)	13.07 (4.59, 37.24)	5.10 (2.15, 12.09)
4	Chocolate		3.19 (2.69, 3.79)	3.10 (2.57, 3.73)	4.07 (2.02, 8.19)	2.52 (0.95, 6.66)	5.13 (2.55, 10.30)
5	Spirit		11.1 (8.37, 14.8)	10.9 (8.01, 14.7)	8.48 (2.26, 31.8)	7.51 (1.99, 5.21)	36.8 (7.36, 183.7)

Showing 1 to 5 of 9 entries Previous 1 2 Next

# Discussion (1)

- All unhealthy foods emerged from CA were significantly more likely to be eaten after 8pm.
- These included alcoholic/sweetened beverages, chocolates and other foods rich in added sugars and saturated fats like biscuits and ice-cream.
- Foods and drinks consumed in the evening/night time tend to be highly processed and easily accessible.

# Discussion (2)

- Assessing the relationships between less healthy foods and timing of eating is a first step towards identifying specific public health targets for behaviour change/modification.
- Undiagnosed T2D patients might be at risk of causing/worsening their condition as they had higher odds to consume a number of less healthy foods after 8pm (sugar-confectionery, sweetened soft drinks).
- The survey cross-sectional nature warrants further investigations by longitudinal cohort studies.

# Thanks

