ASSOCIATION BETWEEN DIETARY SCORES AND 13-YEAR WEIGHT CHANGE AND OBESITY RISK IN A FRENCH PROSPECTIVE COHORT: COMPARISON OF THEIR PREDICTIVE VALUE

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Background

- **Obesity**: word-wide epidemic, risk factor for chronic diseases
- Weight gain results from an imbalance between energy intake and expenditure, but the degree to which various dietary factors contribute to weight gain remains unclear
- Few prospective studies on the association between ***a priori dietary scores*** and **weight gain** or the **risk of obesity**
- Potential **protective effect of Mediterranean diet** on weight gain but **only one study compared** different Mediterranean diet scores with regards to weight change (Beunza *et al.* AJCN 2010)
- Other diets?

Objective

In a middle-aged population-based sample, the SU.VI.MAX. cohort:

- To assess the association between six dietary scores and
  - **weight change** after 13 years of follow-up
  - the **risk of becoming obese** after 13 years of follow-up
- To **compare their predictive value** on obesity risk

Methods

- Subjects n= 3,151
  - Age 45-60 years at baseline
  - 13 years follow-up: 1994 - 2007
- Anthropometric data
  - Height and weight measured at clinical examination
- Diet
  - At least 3 24hour records during first 2 years of follow-up → account for weekly and seasonal variability
  - Mean = 10.2 records per person
  - Computation of 6 diet scores
  - 3 nutritional guidelines-based scores: PNNS-GS (French), DGAI (American), DQI-I (international comparison)
  - 3 mediterranean: MDS, rMED, MSDPS

Methods: selected scores (1)

PNNS-GS Based on French recommendations of the National Program on Nutrition and Health	Estaquio *et al.* (2009)	Score range : **up to 15**, can be negative due to negative points and penalties for high energy intake **12 nutritional components** : fruit and vegetables, starchy foods, whole grain, dairy products, meat , seafood, added fat, vegetable fat , sweets, water and soda, salt . **1 component** on **physical activity** **Penalties if energy intake** > 5% of energy need
Diet Quality Index–International DQI-I	Kim *et al.* (2003)	**Score range : 0-100 points** , four groups of components: **Variety**: overall food group variety (0–15 pts); within-group variety for protein source (0–5 pts) **Adequacy**: vegetables, fruits, cereals, fibre, protein, Fe, Ca, vitamin C (0–5 pts each). Nutritional recommendations are specific to the country where the score is applied, here France. **Moderation**: total fat, saturated fat, cholesterol, Na, empty-energy foods (0–6 pts) **Overall balance**: macronutrient ratio (carbohydrate:protein:fat, 0–6 pts); fatty acid ratio (PUFA:MUFA:SFA, 0–4 pts)
Dietary Guidelines for Americans Index DGAI	Fogli-Cawley *et al.* (2009)	**Score range : 0-20 points** Recommendations depend on energy needs calculated with BMR and physical activity level for each subject **11 items for foods**: dark green vegetables, orange vegetables, legumes, other vegetables, starchy vegetables, fruits, variety, meat and beans, dairy products, all grains, discretionary energy; **9 items for healthy choices**/nutrient intake: >50% of grains as whole grains, fibre intake, total fat, saturated fat, trans fat, dietary cholesterol, % of dairy products that are low-fat, % of meat products that are low-fat, Na, alcohol

Methods: selected scores (2)

Mediterranean Diet Scale **MDS**	Trichopoulou *et al.* (2003)	Score range : **0 - 9 points** **5 beneficial** components 1 point if above ***sex-specific median***, 0 if below : **fruit**, **vegetable**, **legumes**, **grains**, **fish** **2 detrimental** components 1 point if below median, 0 if above : **meat**, **dairy** products 1 component on **fat** : **Mono-unsaturated Fatty Acids / Saturated Fatty Acids** ratio 1 component on **ethanol** : 1 point if within a range of intake (10-50g/day for men, 5-25g/d for women)
Relative Mediterranean score **rMED**	Buckland *et al.* (2010)	Score range : **0 - 18 points.** Same 5 beneficial components as MDS but points 0,1,2 attributed to tertiles 1, 2 and 3, inverse quotation for the 2 detrimental components Component on fat: olive oil intake 0 point for non consumption, 1 point below median, 2 points above,
Mediterranean Style Dietary Pattern Score **MSDPS**	Rumawas *et al.* (2009)	Score range : **0 - 100 points** **13 components**, 10 points each : **whole-grain**, **cereals**, **fruits**, **vegetables**, **dairy**, **wine**, **fish**, **poultry**, **olives-legumes-nuts**, **potatoes**, **eggs**, **sweets**, **meats**, **olive oil**. Scoring depends on number of servings recommended per day or week (e.g. consume 60% of recommended serving, score = 6). If consumption is above recommended number of servings, points are deducted accordingly. Negative points are possible. *Only "a priori" score stricto sensu*

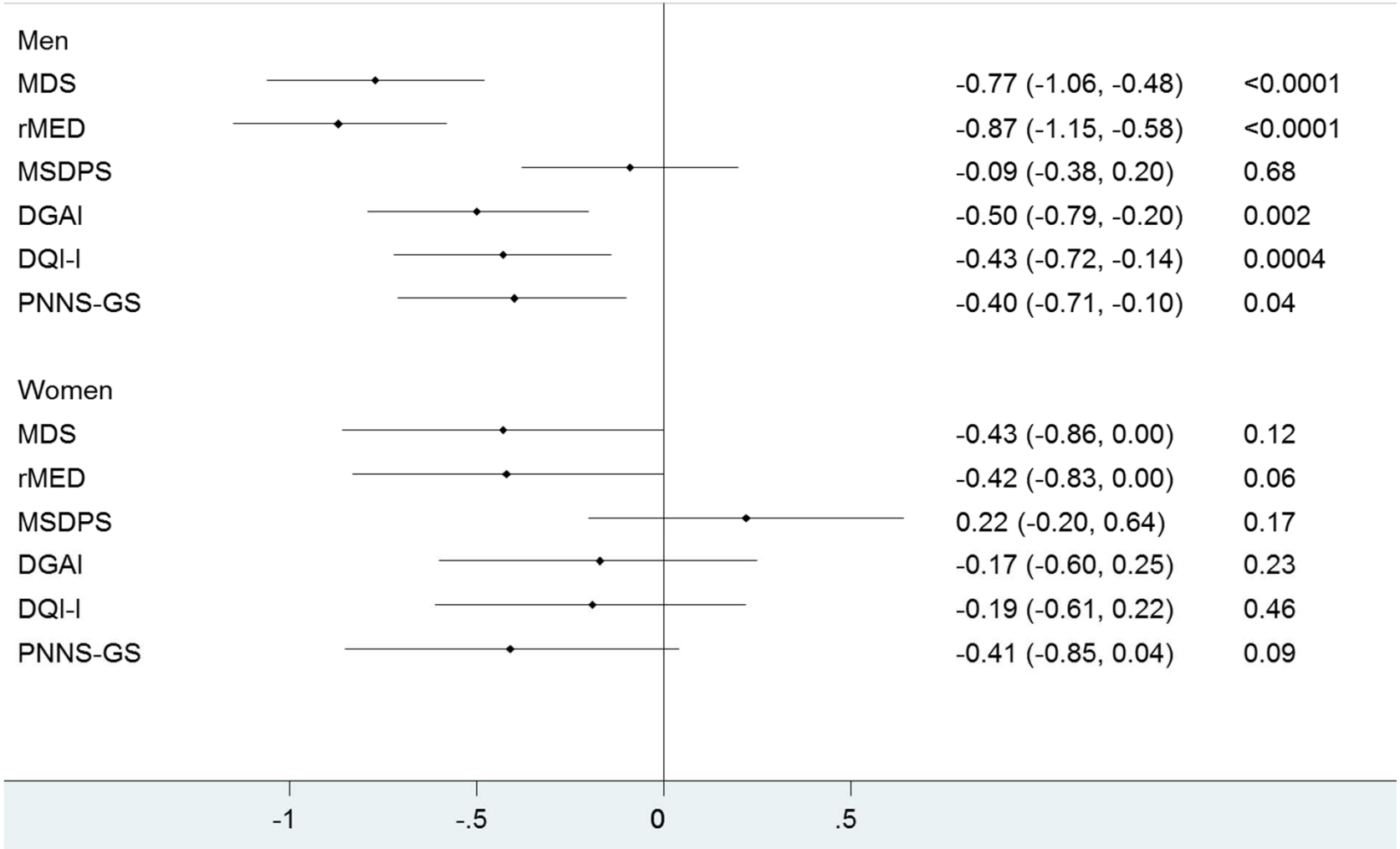
Methods: statistical analysis

- Association of scores with weight change:
  - → Weight change expressed as percentage of baseline weight
  - → Standardized diet scores
  - → Quartiles of scores
  - → Multivariate linear regressions: β for increase of 1 SD of score
- Association of scores with obesity risk
  - → Standardized diet scores and quartiles of scores
  - → Multivariate logistic regressions: OR of becoming obese for increase of 1 SD of score (continuous)
- Comparison of predictive value of 6 scores on obesity risk :
  - Area under the receiver operating characteristic curves (AUC)
  - (Relative) Integrated Discrimination Improvement (Pencina et al. 2008): measures the increased discrimination upon replacement of one score by another in the prediction model

Results (1) : Participants characteristics

- Middle aged people at baseline (1994):
  - 52.3 (4.6) years (men), 51.0 (4.5) (women)
- Mean weight change over 13y:
  - +1.9 (4.6) kg (men)
  - +2.6 (5.2) kg in women.
- Overweight at baseline men vs women : 47% vs 20%
- Obesity incidence after 13y : 123 cases (7.9%) in men vs 84 cases (6.1%) in women

Results (2) Weight change

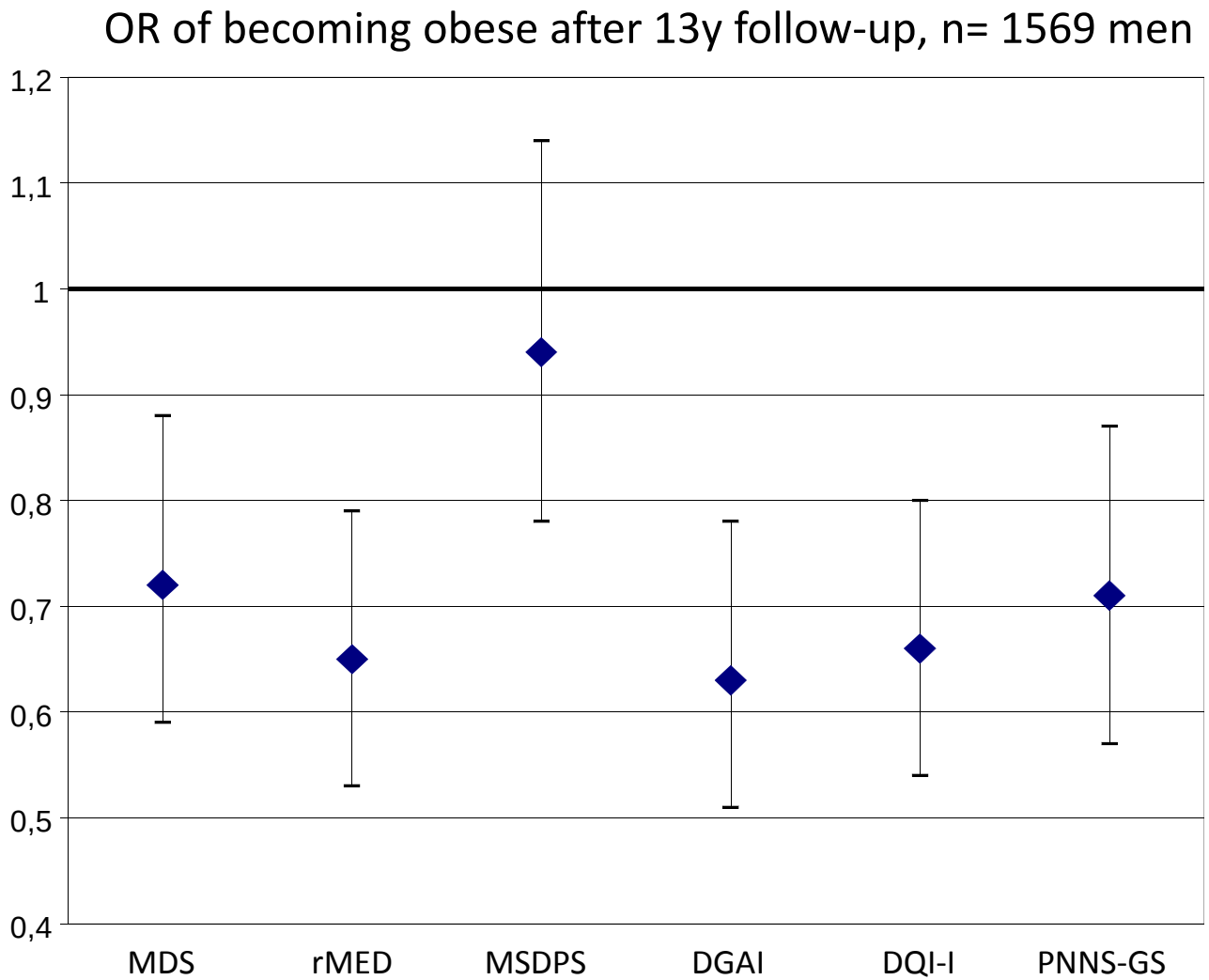


β represents decrease or increase in 13-year weight gain (% of baseline weight) for 1 standard deviation increase in dietary index

P for linear contrast across quartiles

Adjusted for age, energy intake and number of 24h records, smoking status, education, supplementation group, baseline weight and height, physical activity for all scores except PNNS-GS, and menopausal status for women.

Results (3) Obesity risk



ORs for the increase of 1 SD of score

Adjusted for age, energy intake and number of 24h records, smoking status, education, supplementation group, baseline weight and height, physical activity for all scores except PNNS-GS.

Results (4) Comparison predictive value

	AUC	p for AUC difference	IDI	p for IDI	RIDI
Model 1 with PNNS-GS	0.641				
Replace PNNS-GS by MDS	0.643	0.91	-0.001	0.7615	-5.0%
Replace PNNS-GS by rMED	0.659	0.43	0.010	0.0221	50.6%
Replace PNNS-GS by MSDPS	0.611	0.15	-0.010	0.0002	-50.3%
Replace PNNS-GS by DGAI	0.663	0.33	0.006	0.1162	31.0%
Replace PNNS-GS by DQI-I	0.666	0.20	0.010	0.0185	47.7%
Overall P		0.27			

- PNNS-GS as reference
- No significant difference in AUC
- IDI (Integrated Discrimination Improvement):
  - PNNS-GS predicts signicantly better than MSDPS
  - rMED and DQI-I predict significantly better than PNNS-GS

Discussion (1)

- All scores show an association with weight gain and obesity risk: confirms the role of Mediterranean diet and nutritional guidelines in weight management, even if they are different concepts
- But... no association with MSDPS
  - developed for use in an American population, dietary intake assessed by a FFQ → may not be suitable to our type of population
  - cutoff values may be too stringent compared to the dietary habits in our French population
  - component scorings bell-shaped distribution for each recommendation → individuals with increased consumption of fruits and vegetables or non-consumers of sweet foods are assigned lower sub-scores
- Lower association for women
  - potential confounding effect of hormonally-mediated menopausal weight gain
  - smaller number of obesity cases among women → insufficient statistical power?

Discussion (2)

- Long-term prospective design but selection bias due to volontary inclusion of participants, may be particularly compliant / health-conscious
- Comparability of the predictive values of these dietary indices → they share common characteristics
- All of them indicate a potential protective effect regarding weight gain in a French context, even though they were not initially developed for that population

Conclusion

- Quality of diet at baseline, measured by different dietary scores, is a good predictor of weight gain across gender after 13 years of follow-up
- Various dietary scores predicted almost equally well obesity risk in French middle-aged men
- The findings of this prospective study support the role of a healthy diet in long-term weight control.

- Lassale C, Fezeu L, Andreeva VA, Hercberg S, Kengne AP, Czernichow S, Kesse-Guyot E. Association between dietary scores and 13-year weight change and obesity risk in a French prospective cohort. Int J Obes (Lond). 2012 Jan 17. doi: 10.1038/ijo.2011.264.

Thank you

for your attention!