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The Leeds food preference questionnaire after mild sleep restriction — A small feasibility study☆,☆☆

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HIGHLIGHTS

- The Leeds Food Preference Questionnaire (LFPQ) can be used after sleep restriction.
- The LFPQ is easily implemented and translation is straightforward.
- LFPQ scores are comparable on repeated testing.
- The effect of napping on LFPQ score remains elusive.

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ABSTRACT

Besides the increased sedentary lifestyle and increased caloric intake, changes in dietary composition may play an important role in the increased prevalence of obesity. Because inadequate sleep could be a risk factor in the aetiology of obesity, reliable methods for assessing food intake and food choice after sleep restriction are needed. We translated the Leeds food preference questionnaire (LFPQ), addressing preferences for sweet/savoury tastes and low-fat/high-fat foods, into Dutch, and tested it in 15 mildly sleep-restricted psychology students. The participants completed the LFPQ in our laboratory on two separate occasions, with approximately one week in between. Sleep on the preceding night was not controlled, but mild sleep-restriction was confirmed by a short sleep latency test (sSLT) or a short maintenance of wakefulness test (sMWT). Each participant completed the sSLT and sMWT once, just before the LFPQ, in a cross-over design randomised for the first test.
Differences were present in preferences for food items from different categories (sweet/savoury and low-fat/high-fat; $p < 0.001$). The choice frequencies for various food categories were comparable on both occasions ($p = 0.27$). The choice frequencies for individual items were also comparable on both occasions ($p = 0.27$).
The LFPQ is easily implemented under mild sleep-restricted conditions, and translation is straightforward. Future studies using the LFPQ after sleep restriction could elucidate if restricting sleep or longer periods affects food choice, which could underlie increases in obesity risk.

1. Introduction

Although obesity prevalence varies widely between populations (from 0.7 to 70%), prevalence is on the rise worldwide [1]. The most likely causes for the global obesity pandemic are an increasingly sedentary lifestyle and the high abundance of food with a high caloric content but of reduced nutritional quality [1].

Sleep shortage affects food choice in real life situations; it affects snacking [2], irregular eating, excessive seasoning of food, insufficient consumption of vegetables [3] and consumption of energy-rich foods

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☆☆ CHCL, AA & DS designed and performed the experiments. CHCL analysed the data. CHCL, JZ and AK interpreted the data and wrote the paper. All authors read and approved the final version of the paper.

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[4]. Sleep deprivation can also alter the motivation underlying food choice [5], and short-sleeping (<6 h/day) female students choose less healthy foods than those sleeping longer [6].

Increased availability of processed foods has probably resulted in altered food intake, either quantitatively or qualitatively [1], which is relevant when investigating risk factors for obesity. While quantitative food intake is of interest concerning the risk for adverse outcomes, knowing more about qualitative food choice may be more valuable when we consider preventive measures.

Both observational and experimental studies have addressed food intake in relation to sleep. E.g. snack dominance [2], irregular eating, snacking, excessive seasoning of food and insufficient consumption of vegetables [3] and macronutrient intake [7] have been examined in real-life situations. Laboratory measures are more objective than self-reported measures of food intake and reflect individual differences in eating behaviours [8]. In laboratory settings, intake of ad-libitum meals and snacks (e.g. [9]) and purchase of food in a mock-supermarket [10] have been investigated after sleep curtailment. In these studies, food intake was measured with questionnaires estimating past intake of certain items, or food groups, or frequencies of dietary habits, besides food diaries, weighing of ad libitum meals before and after intake, disappearance of items from a "snack bar", or having participants choose how to spend ±50 US dollars on 40 available items on display to stock up for a week. None of these studies directly addressed the preference of the participants for sweet versus salty foods, or the preference for low vs. high fat items.

Finlayson et al. developed a simple food choice questionnaire (the Leeds food preference questionnaire; LFPQ) based on 20 food items common to the western-world diet, which were selected to fall within four categories: 5 high-fat (>50% energy) sweet (HFSW) items, 5 low-fat (<20% energy) sweet (LFSW) items, 5 high-fat savoury (HFSA) items and 5 low-fat savoury (LFSA) items [8–14]. Items are generally similar in familiarity, protein content and palatability [8]. Participants filling out the LFPQ are asked to choose which of two food items they would prefer to eat right now, yielding choice frequencies for each item and each category reflecting the Relative Preference (RP).

The effect of sleep on LFPQ completion has not been reported previously, while the LFPQ is highly suitable to investigate RP for savoury versus sweet and for high versus low fat because of its structure. Because the LFPQ is a somewhat long and repetitive questionnaire, we were concerned that completion could be challenging in a sleep-restricted state.

We performed a small experiment in 15 psychology students participating in a larger observational study [7] to assess the feasibility of using the LFPQ after mild sleep restriction. We verified sleepiness by conducting single-trial versions of the sleep latency test (sSLT) and maintenance of wakefulness test (sMWT). In addition, we investigated the test–retest reliability of the LFPQ by calculating the coefficient of stability over the two separate test days, which has not been evaluated before.

2. Materials and methods

The study was approved by the Ethics Committee of the Faculty of Psychology and Neuroscience at Maastricht University. It was performed in accordance with the ethical standards of the 1964 declaration of Helsinki. Second-year psychology students received course credit in exchange for their participation.

A subset of 15 second-year psychology students from a larger observational study [7] came to the laboratory on two occasions, separated by approximately one week. For this subset, inclusion criteria were being a second-year psychology student aged 18–50 years.

Participants were asked to shorten their regular sleep time by two hours on the night preceding both experimental days (by waking up earlier or going to bed later as they preferred), and to abstain from caffeine-containing beverages on the morning of both of these days. Except for 30 min of fasting immediately preceding the test, food intake before taking the questionnaire was not controlled.

When students arrived at the lab, they were prepared for polysomnography, and underwent a short sleep latency test (sSLT) or a short maintenance of wakefulness test (sMWT), verifying their sleepiness. The sSLT and sMWT were performed in a within-subject cross-over design.

This study also investigated if short naps (during the sSLT) alter the relative preference for sweet, high-fat items. Thus, the participants completed the LFPQ *after* the 30 min sleep or wakefulness test instead of before.

2.1. LFPQ

The LFPQ designed by Finlayson [11–14] shows pairs of food items (each item consisting of a picture + text). Participants are asked to choose which item they would prefer to eat right now. Twenty items (Table 1) distributed over four categories (5 high-fat (>50% energy) sweet (HFSW) items, 5 low-fat (<20% energy) sweet (LFSW) items, 5 high-fat savoury (HFSA) items and 5 low-fat savoury (LFSA) items) were paired with all items from the other categories resulting in 150 food pairs. Considering e.g. the HFSA category, the 5 HFSA items were paired with all 15 items from the other three categories. Choice frequency (# of choices) for HFSA could thus range from 0 to 75; 0 if never choosing an HFSA item, and 75 if always choosing an HFSA-type food when one was offered.

The original English text was translated to Dutch and programmed in Qualtrics. The list of items was not adapted, but corresponding pictures were chosen with the Dutch market in mind (i.e., all pictures looked familiar and appealing to Dutch students). Order and side (left/right) were fully randomised to control for potential order effects and side biases. A progress bar was included to allow the participants to monitor their progress. Only after performing the experiments we realized that shorter variants of the LFPQ have been used in Dutch populations before [16–18].

Participants completed the LFPQ on a standard PC in the laboratory. Participants were asked to take place on a chair facing the PC. They were asked to choose which item they would prefer to eat right now by written instruction on top of the computer screen. Stimuli were 7.5 × 5.0 cm

Table 1
Popularity of the different food items in the LFPQ reflected by average choice frequency of the individual item (SEM). Number of choices for each item was compared between conditions with two ANOVAs. No significant effects of test day ($p = 0.27$) or sleep condition ($p = 0.06$) on choice frequency were observed. Pearson's correlation coefficients for choice frequency on the first and second test are provided.

Item (category)	1st test	2nd test	R	sSLT	sMWT
Spaghetti in sauce (LFSA)	11.8 (0.8)	11.3 (0.9)	.703**	10.8 (0.9)	12.3 (0.8)
Blueberry muffin (HFSW)	10.6 (1.0)	10.6 (0.9)	.610*	10.9 (0.9)	10.3 (1.0)
Pilaf rice (LFSA)	10.5 (1.1)	9.9 (1.2)	.634*	9.6 (1.2)	10.8 (1.1)
Fruit salad (LFSW)	9.9 (1.2)	10.3 (0.6)	.452	10.1 (0.6)	10.1 (0.8)
Shortbread (HFSW)	9.9 (0.8)	10.1 (1.1)	.898**	9.7 (1.1)	10.2 (1.1)
French fries (HFSA)	9.8 (1.2)	9.5 (1.0)	.763**	9.6 (1.2)	9.7 (1.1)
Bread roll (LFSA)	9.3 (0.9)	9.4 (1.0)	.677**	8.5 (1.0)	10.2 (0.8)
Jam doughnut (HFSW)	8.8 (1.1)	9.5 (1.1)	.594*	10.0 (1.2)	8.3 (0.9)
Salted peanuts (HFSA)	8.6 (0.7)	7.1 (1.1)	.714**	7.5 (1.1)	8.2 (0.7)
Cream cake (HFSW)	8.3 (1.0)	8.0 (1.0)	.667**	8.3 (0.9)	8.0 (1.1)
Milk chocolate (HFSW)	8.2 (0.9)	8.8 (0.9)	.629*	8.7 (0.9)	8.3 (0.9)
Savoury biscuits (LFSA)	8.1 (0.7)	8.1 (0.8)	.622*	7.9 (0.8)	8.3 (0.7)
Salted crisps (HFSA)	7.7 (1.0)	7.9 (0.9)	.687**	7.9 (0.9)	7.7 (1.0)
Boiled potatoes (LFSA)	6.5 (1.0)	6.1 (1.0)	.765**	6.2 (1.0)	6.3 (1.0)
Popcorn (LFSW)	5.9 (1.1)	5.7 (0.9)	.660**	6.3 (1.0)	5.4 (1.1)
Mixed olives (HFSA)	4.7 (1.2)	4.5 (1.2)	.826**	4.4 (1.2)	4.8 (1.1)
Marshmallows (LFSW)	3.5 (0.9)	3.9 (0.9)	.899**	3.8 (0.9)	3.6 (0.9)
Swiss cheese (HFSA)	3.1 (1.0)	3.1 (1.1)	.901**	3.4 (1.2)	2.8 (0.9)
Jelly sweets (LFSW)	2.9 (0.9)	4.0 (0.9)	.635*	4.0 (0.9)	2.9 (0.9)
Jelly (Jello; LFSW)	1.9 (0.5)	2.1 (0.6)	.481	2.1 (0.7)	1.9 (0.5)

* Indicates significance at the 0.05 level.
** Indicates significance at the 0.01 level.