Relationships between patterns of food intake and a tendancy to being overweight among shift workers. A Pradignac, M Velten, JL Schlienger, B Canguilhem *(Groupe d'étude sur la nutrition, médecine interne, CHU de Hautepierre, 67098 Strasbourg cedex, France)*

Shift work frequently exposes employees to becoming overweight because of an increase in the amount of nocturnal eating, a reduction in the number of meals or an increased caloric intake during days off. The goal of this study was to analyse the relationships between work schedule, rhythm of food intake and corpulence.

After pairing them for age, work rank, marital status, and length of service, we selected 123 workers of the National Railway Company and divided them into four groups according to their work schedule: daytime work (DT; $n = 36$), shift work 3 * 8 ($n = 29$) or 2 * 8 ($n = 30$) and work with a varying schedule (VS; $n = 28$). Body mass index (BMI) was calculated for each subject. Rhythm of food intake was assessed by a qualitative questionnaire that assessed food intake at seven possible times of the day (breakfast, morning, lunch, afternoon, dinner, evening, night) during work days and days off. For each period, the answer was "yes" if the workers ate something or "no" if they did not. Food intake of the shift workers (3 * 8 and 2 * 8) differed from that of the two other work groups: dinner was frequently replaced by an afternoon snack during the afternoon shift; breakfast and lunch were often suppressed during the night shift whereas a night snack was eaten. BMI was greater in shift workers (27.1 and 27.0 vs 25.6 and 25.5 kg/m^2; $P < 0.05$). A logistic backward regression was performed to clarify the relationships between BMI and work eating habits where the independent variables included daily food intake, age, number of meals and snacks, work group and work schedule. A positive relationship was noted between BMI and the reduction of the number of meals (OR = 5.72; $P = 0.001$). This relationship was independent of work group, work schedule, age and number of snacks.

In conclusion, shift work seemed to impair food intake and affect body weight more than another work schedule (DT or VS). The increase in weight could result from a diminution of the number of meals whereas the number of snacks did not seem to be significant.

Influence of shift work, BMI, smoking and dietary intake on triglyceride-rich lipoparticles. M Romon [1], MC Nuttens [1], C Fievet [2], JM Bard [2], P Frimat [3], JC Fruchart [2] *([1] CHRU-Lille; [2] Serlia, Institut Pasteur de Lille; [3] Cereste, Lille, France)*

Studies on the protein moiety of lipoparticles have underlined the protein heterogeneity of lipoprotein density classes. To improve the structure-function definition, it has been suggested that lipoproteins be classified according to their apoprotein content. According to this classification, triglyceride-rich lipoparticles consist mainly of two types of apoprotein B containing lipoparticles: LpB:CIII and LpE:B. We have previously shown [Romon et al (1992) *Am J Med* 93, 259-262] that shift work was associated with higher triglyceride (TG) levels. The aim of this study was to investigate the effects of shift work and environmental factors on TG-rich lipoproteins. This study was conducted among 136 male workers divided into two groups: 68 shift workers (aged 21.1–42.7 years) and 68 day workers (aged 22.2–42.6 years), matched for occupational physical demand, educational level and age. Data collection consisted of a questionnaire about smoking and leisure time physical activity, standardized weight and height measurements and an assessment of dietary intake by a 3-day record. Fasting blood samples

were drawn for an assessment of cholesterol (C), TG, apoproteins A and B, LpB:CIII and LpE:B levels. Statistical differences were tested by the Student's *t*-test. For each lipidic parameter, a stepwise linear regression was conducted to evaluate the independant contribution of shift work, age, body mass index (BMI), smoking, energy and alcohol intake. Both groups did not differ for BMI, energy intake and smoking. Whereas, day workers had a higher alcohol intake (15.6 vs 9.3 g, $P = 0.03$), TG (1.25 ± 0.61 vs 0.99 ± 0.56, $P = 0.004$) and LpB:CIII (0.22 ± 0.15 vs 0.17 ± 0.1, $P = 0.03$) were higher among shift workers. In the stepwise linear regression, shiftwork ($\beta = 0.27$, $P = 0.008$), BMI ($\beta = 0.26$, $P = 0.009$) and smoking ($\beta = 0.2$, $P = 0.005$) contributed independantly to TG level. LpB:CIII was only associated with shift work ($\beta = 0.18$, $P = 0.01$) and LpE:B with smoking ($\beta = 0.25$, $P = 0.003$). We did not find any relationship between alcohol and TG, perhaps because of the relatively low alcohol intake among this population. This study suggests that shift work and smoking-induced hypertriglyceridemia may have different mechanisms: higher production by stress-induced lipolysis in case of shift work, whereas increased levels of LpE:B suggest an impaired removal among smokers.

FOODS–NUTRIENTS

Resistant starch may have a more potent cholesterol-lowering effect than cholestyramine, in spite of having less effect on the fecal excretion of neutral or acidic steroids. H Younes, MA Levrat, C Demigné, C Rémésy *(Laboratoire des maladies métaboliques, Inra-Clermont-Ferrand/Theix, 63122 Saint-Genès-Champanelle, France)*

Cholesterol elimination from the body pool takes place chiefly in the digestive tract, especially as bile acids and various plant products (fibers, resistant starch, phytosterols, polyphenols) or resins (cholestyramine) are able to enhance the fecal excretion of steroids. Abadie et al (1994) have shown that resistant starches also have a capacity for bile acid adsorption, in particular chenodeoxycholic and deoxycholic acid. The question arises as to whether these resistant starches have cholesterol-lowering effects comparable to those of certain soluble fibers or steroid-sequesterants.

In the present experiment (diets containing 5% groundnut oil), the resistant starch was crude potato starch (25% in the diet), replacing wheat starch (basal: 73%). Three experimental groups were used: controls, cholestyramine 0.8% or resistant starch 25%. The underlying aim of this work was to assess the respective effects of the fermentations and of the stimulation of bile acid excretion on plasma lipids.

Resistant starch is readily fermented by microbial microflora and it induces a considerable increase in the production and absorption of short-chain fatty acids (SCFA). Although cholestyramine was more effective at increasing steroid excretion, only resistant starch significantly lowered plasma lipid levels (plasma cholesterol or triglycerides: –30%). In response to accelerated steroid losses, there was an induction of HMG-CoA reductase activity, which was higher with cholestyramine than with resistant starch. FAS activity was depressed in rats fed resistant starch. In these animals, there was a decrease in the amount of cholesterol in all the lipoprotein fractions, especially HDL1 (d 1 040–1 080), whereas there was no significant cholesterol change in this fraction for the rats fed cholestyramine. Differences between resistant starch and cholestyramine were more striking for the TGLRP fraction which only decreased in rats fed resistant starch.

The differences observed between resistant starch and cholestyramine could be