

# Circadian rhythm of Glomerular filtration (GFR) rhythm and sodium-excretion in children with enuresis

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## Introduction

Nocturnal diuresis is subtyped in non-monosymptomatic enuresis (**NMNE**) with evidence of underlying bladder dysfunction and monosymptomatic enuresis (**MNE**).

It is accepted that nocturnal polyuria (**NP**) plays a major role in MNE. Although nocturnal polyuria can largely be explained by abnormalities in circadian rhythm of vasopressin, other circadian rhythms in the kidney might be involved.

Recently disturbed day/night rhythms of blood pressure, prostaglandins, solute excretion and GFR were documented in refractory patients.

## Aim

Explore the importance of abnormal circadian rhythm of glomerular (GFR) and tubular (sodium, potassium) parameters in patients with MNE, compared with children documented bladderdysfunction (NMNE) as underlying cause.

## Method

### Retrospective study

- Standardized screening (ICCS questionnaire)
- 14 days diary for nocturnal enuresis and diuresis
- 24h concentration profile: diuresis- volume,- rate, excretion of sodium, potassium, osmolality, creatinin
- Mineralocorticoid effect (UK/(UNa+K))
- Circadian rhythm of creatinin excretion with calculation
  - % creatinin excretion collection / 24h creatinin excretion
  - creatinin mg/min

### Study population

139 children (> 5 years old) with nocturnal enuresis (NE). Tertiary enuresis population (UZ Gent). ♂ 65 %/♀ 35% 58% MNE/42% (NMNE)

**Question 1:** Are there differences in circadian rhythm between MNE and NMNE?

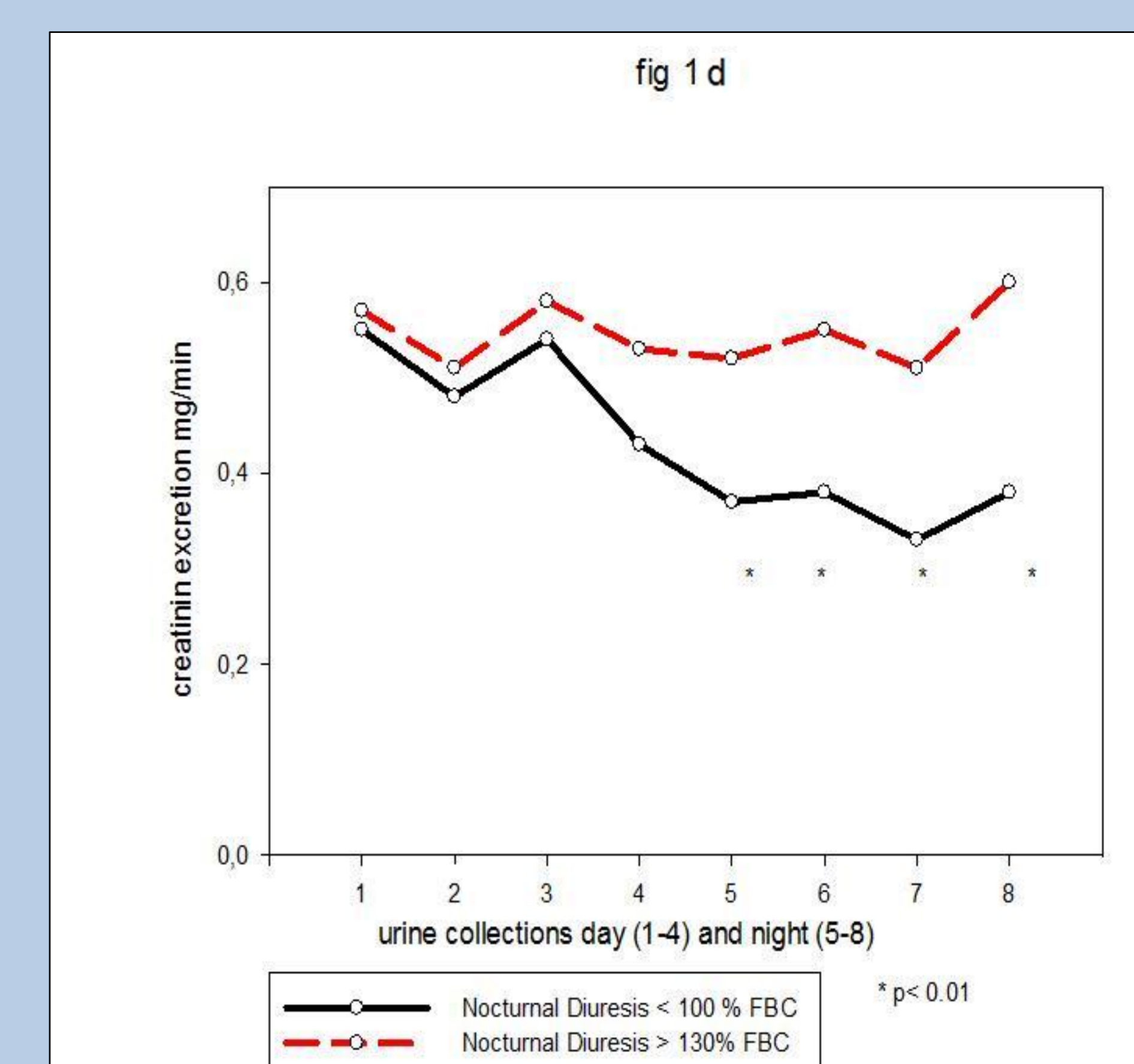
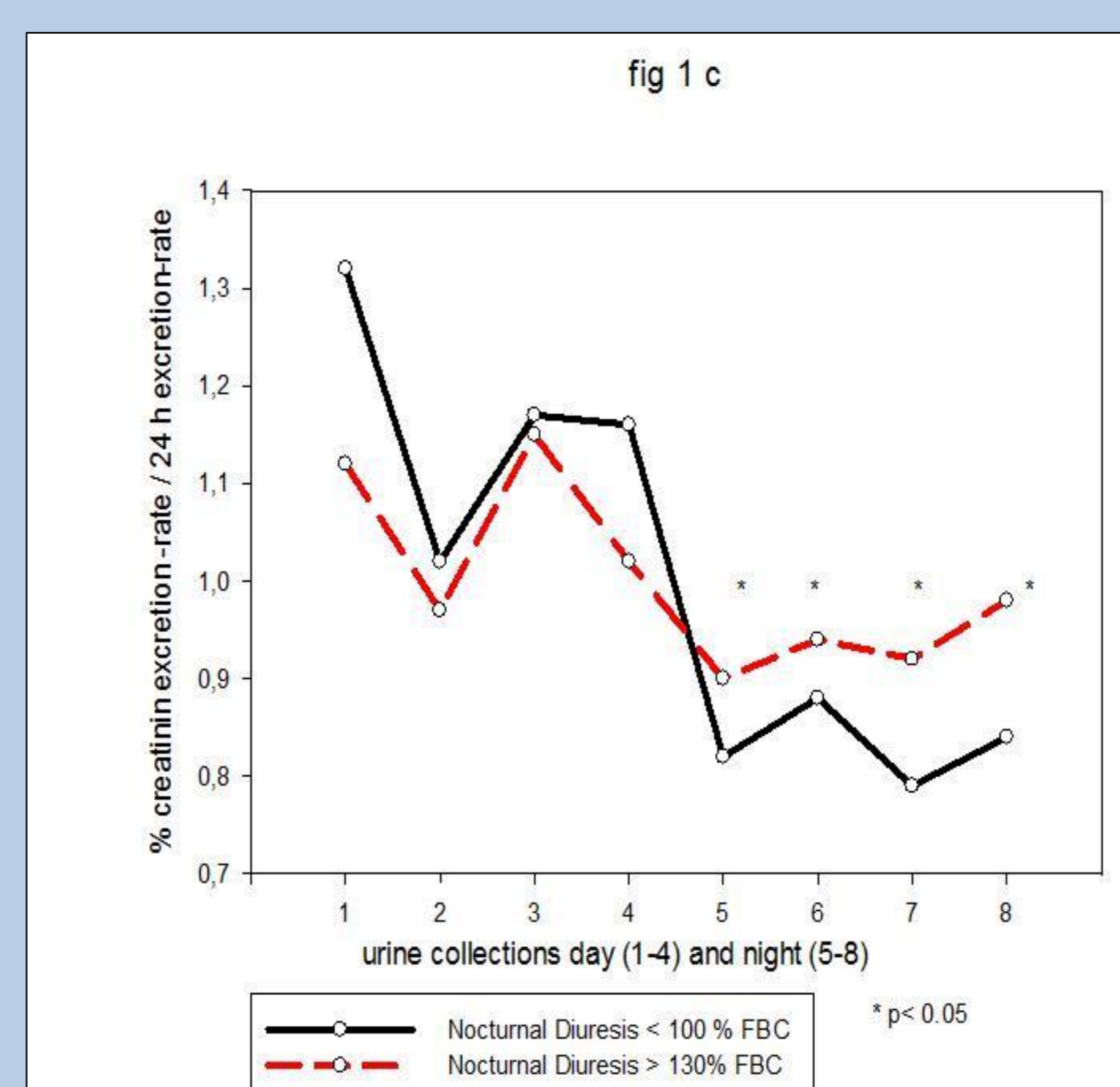
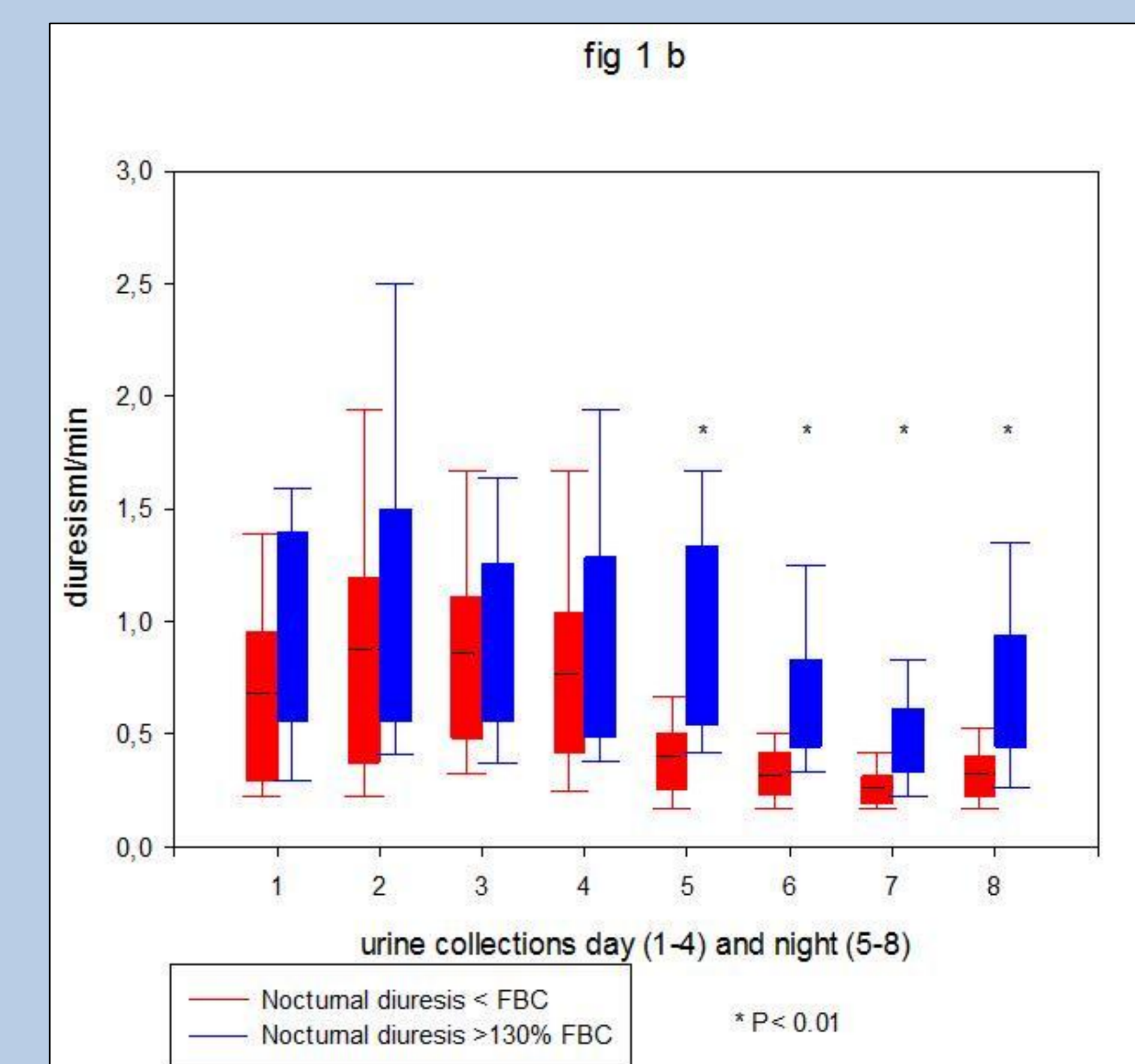
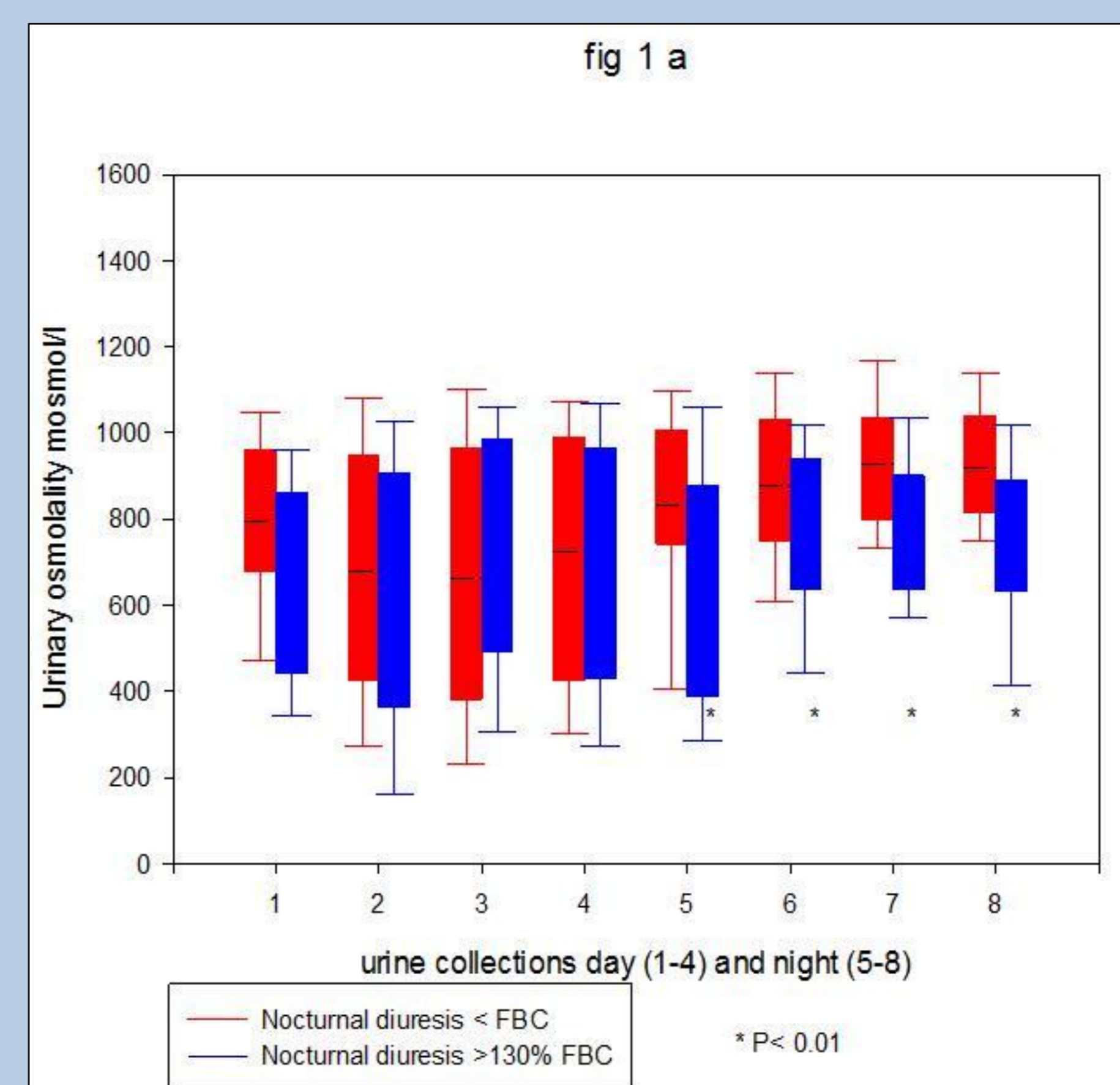
**Question 2:** Are there differences between presence of NP (nocturnal diuresis > 130% FBC) (n = 46) or absence of NP (nocturnal diuresis < 100% FBC) (n = 46)?

## Results

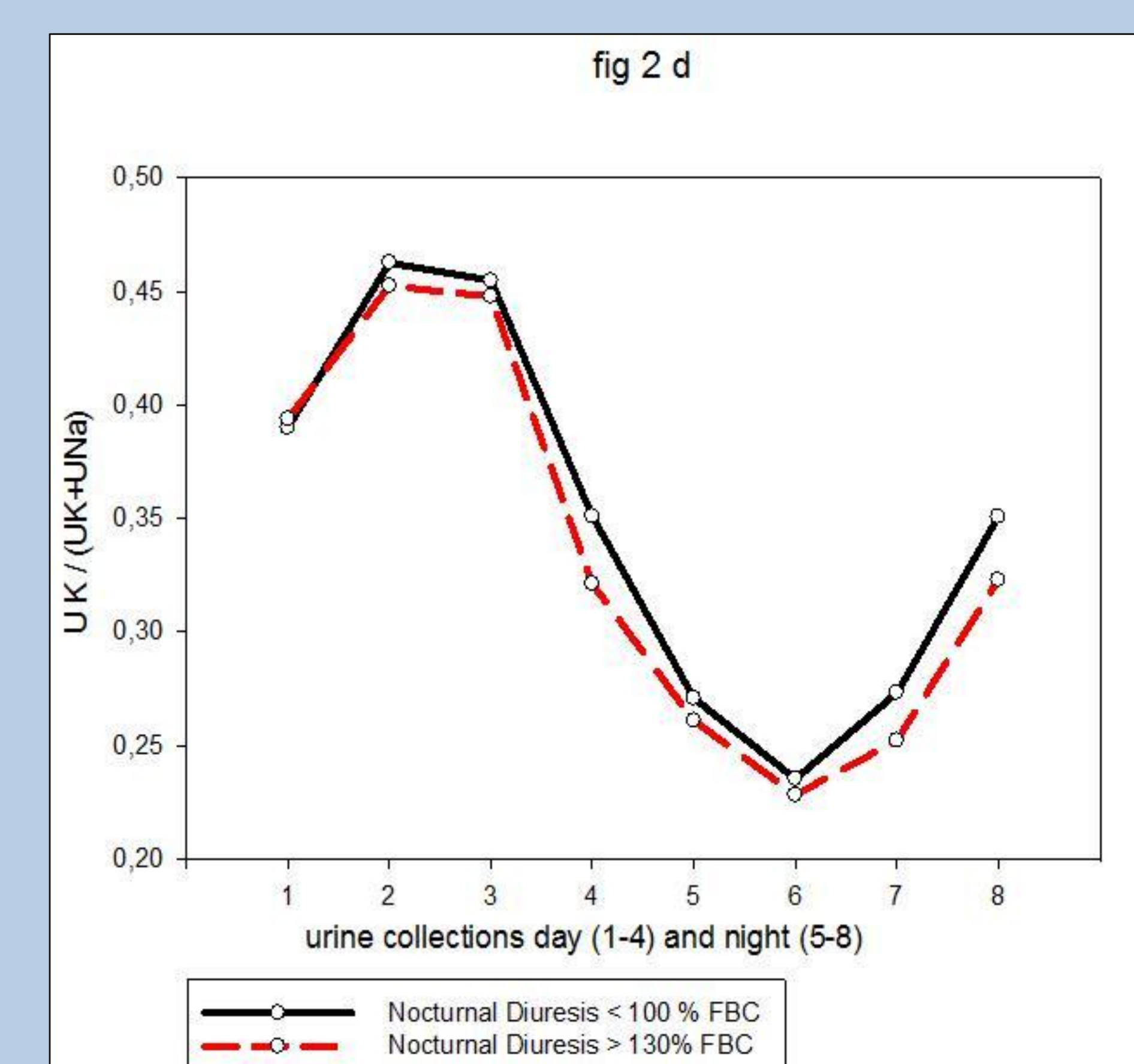
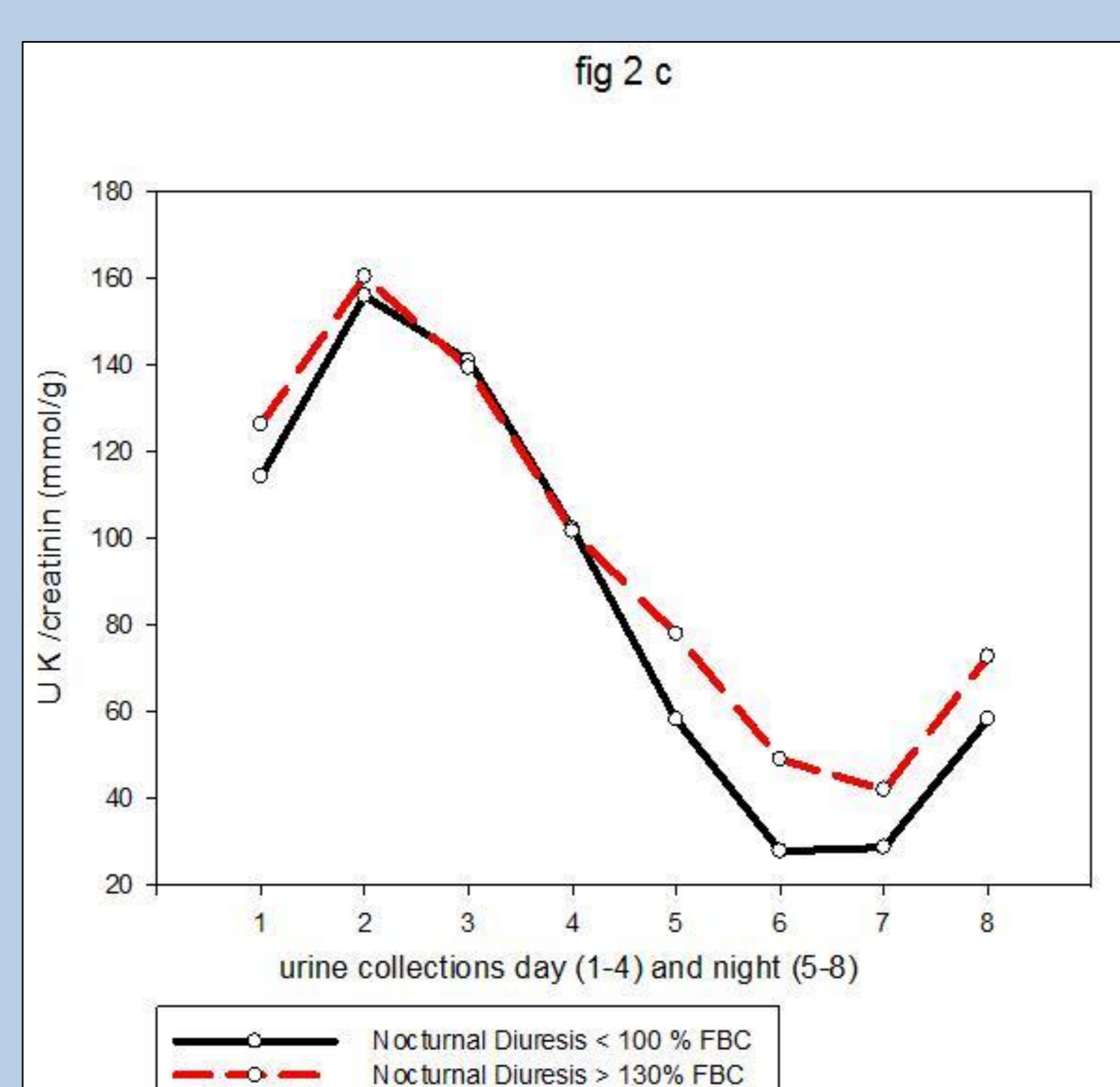
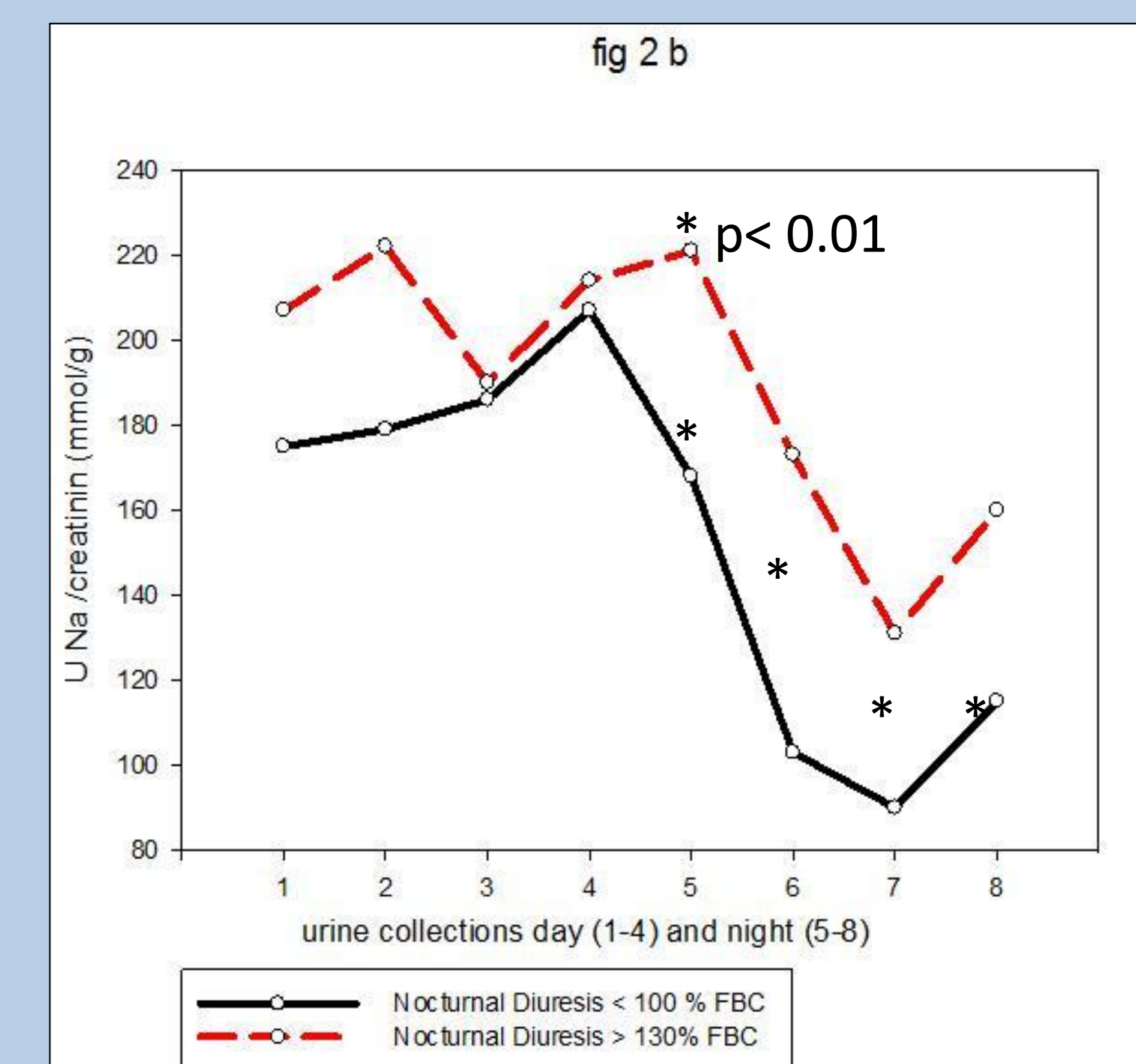
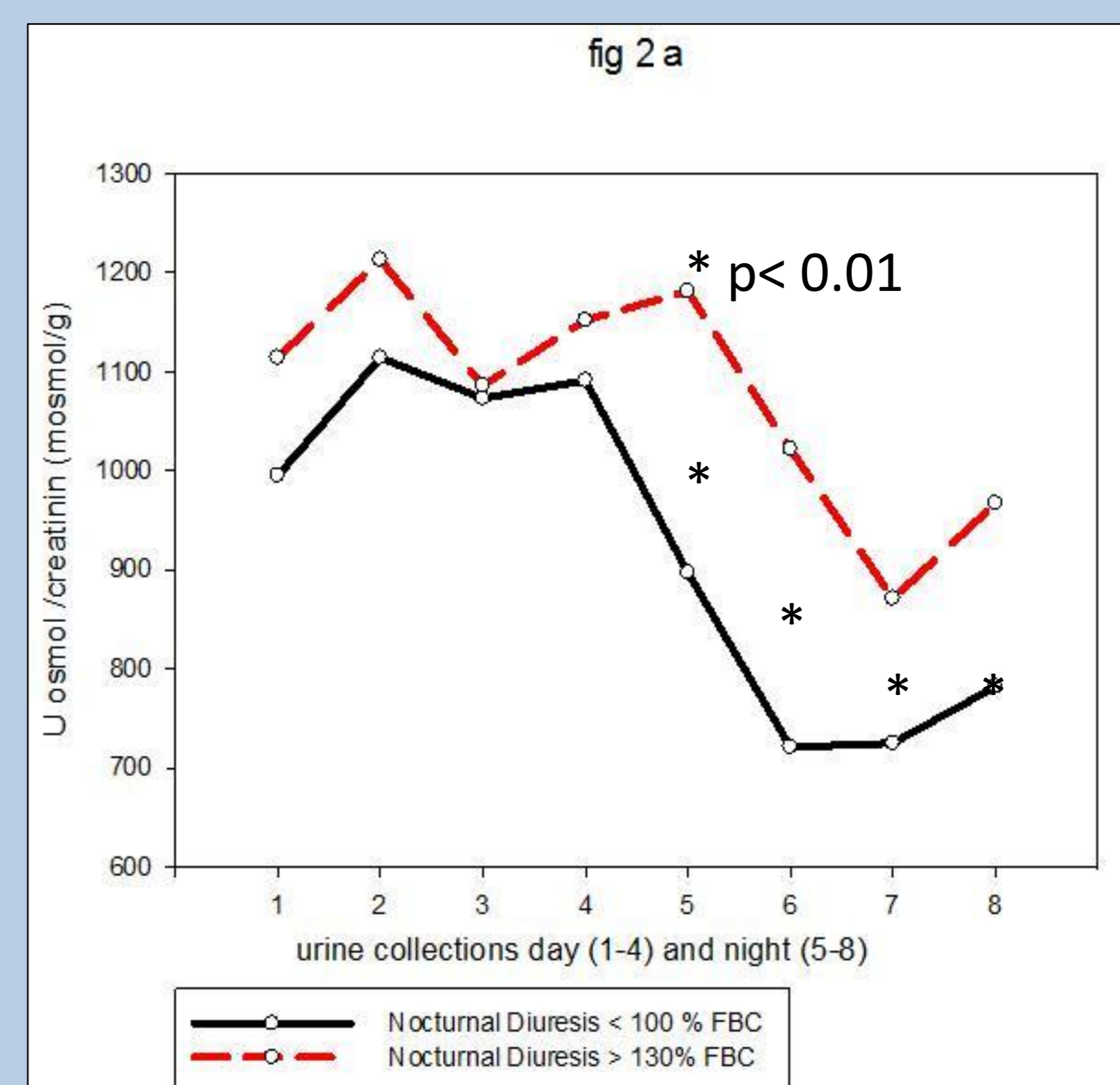
1. Maintained circadian rhythm of GFR, sodium,osmotic excretion and diuresis rate in both children with MNE and NMNE (p<0.01). No significant difference between the two groups.

2. In patients with nocturnal polyuria(> 130% FBC) compared to patients with nocturnal diuresis < 100% FBC (both with MNE and NMNE), not only circadian rhythm of urinary osmolality and diuresis but also creatinin excretion (GFR) are lost. (**Fig 1**)

This is related to abnormal circadian rhythm of solute and sodium excretion, but not of potassium nor mineralocorticoid effect. (**Fig 2**)



**Fig 1:** Circadian rhythm of concentrating activity (urinary osmolality) (**Fig1a**), diuresis rate (**Fig1b**), creatinin excretion expressed as % of 24 hours excretion (**Fig 1c**) and creatinin excretion/min (**Fig1d**)



**Fig 2:** Children with nocturnal polyuria (defined as > 130% FBC age) versus children without nocturnal polyuria (nocturnal diuresis volume < 100% of the FBC age (Hjalmas formula))

## CONCLUSION

Circadian rhythm of the kidney is not different between NMNE and MNE.

The subgroup of enuresis with NP have a diminished circadian rhythm of nocturnal diuresis, sodium-excretion and GFR in contrast with children without NP. This observation can not be explained by the vasopressin theory.