

厚生労働科学研究費補助金(循環器疾患・糖尿病等生活習慣病対策総合研究事業)
(総合) 研究報告書

6. 尿ナトリウム・カリウム比と高血圧の有病率に関する研究—肥満の有無による層別化

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研究要旨基本健診項目の有用性における新規項目案を既存データを用いて行った。
東北地方の一般地域住民2集団において、尿ナトリウム・カリウム比（尿 Na/K 比）と高血圧の関連を肥満・非肥満で層別化して実施した。
令和4年度は、健診や保健指導で追加すべき項目案として、非肥満の高血圧に対する指導がない現状において、尿 Na/K 比測定を用いた指導が有用である可能性を示した。
令和5年度は、尿 Na/K 比の変化と血圧の変化について、肥満・非肥満に分けて層別解析を行い、尿 Na/K 比が肥満・非肥満に関わらず高血圧と関連することが明らかとなり、肥満者に対する保健指導の場において、減量だけでなく尿 Na/K 比を意識するような指導が有用である可能性が示された。
尿 Na/K 比の測定や対象者の選定にコストがかかることから健診受診者全員に測定する利益・不利益、対象者を絞った測定を行う利益・不利益についても十分な検討が必要となる。

A. 研究目的

食塩摂取量が多いものほど血圧が上がることは広く知られている⁽¹⁾。また、野菜摂取が多い者ほど血圧が低下することが知られている。米国の介入研究で食塩量とカリウム摂取量が特徴となる DASH (Dietary Approaches to Stop Hypertension) 食の組み合わせにより、食塩量が少なく、且つ DASH 食に割り当てられた群ほど血圧が低下することが報告されている⁽²⁾。その結果、高血圧ガイドライン等でも減塩と野菜の摂取増加が高血圧患者の食事指導に盛り込まれている⁽¹⁾。

しかしながら、実際の食事に含まれている食塩摂取量と、野菜摂取量を評価することは困難である。24 時間思い出し法でも正確な食塩摂取量の推定は困難である。正確に食塩摂取量を評価しようとする 24 時間蓄尿を行う必要があり、一般住民を対象

とした健康診査（健診）に導入することは困難である。単なる随時尿のナトリウム濃度は脱水状態にあるかどうかで安定せず、随時尿のナトリウム・カリウム・クレアチニン等を用いた推定食塩排泄量・カリウム排泄量の推定も、健診現場でタイムリーに測定することはできない。

そんな中、尿を一滴たらすことで尿中のナトリウムとカリウムの比（尿 Na/K 比）を評価する機器（ナトカリ計）が開発され、健診現場で即時にフィードバックを行うことが可能になった。

尿 Na/K 比は、脱水の状況に影響されないことと、即時評価が可能な機器が存在することが本研究の強みである。

宮城県登米市では、2017 年度より特定健康診査（特定健診）において尿 Na/K 比測定を継続中であり、尿 Na/K 比が高血圧と関連していること、測定後地域全体の尿 Na/K 比・血圧レベルが低下していること、尿

Na/K 比の低下が大きい者ほど血圧レベルの低下が大きいことを既に報告している。

しかしながら、健診受診者全員に尿 Na/K 測定を行うことが現実的でない状況も想像できることから、令和 4 年度は測定すべきものの優先順位を検討するため、対象者を層別化し、分析を行った。分析に用いた集団は、東北メディカル・メガバンク計画地域住民コホート調査参加者で宮城県在住の集団のうち特定健診会場でデータを収集した集団と宮城県登米市の特定健診受診者集団の 2 集団である。

令和 5 年度は、肥満者と比べ非肥満者で尿 Na/K 比変化が血圧に与える影響が大きいという可能性を考え、尿 Na/K 比の変化と血圧値の変化について肥満・非肥満者に分けて層別化解析を行った。分析に用いた集団は宮城県登米市の特定健診受診者と宮城県大崎市の特定健診受診者で、複数年特定健診及び尿 Na/K 比を測定した集団である。

B. 研究方法

令和 4 年度

＜対象 1＞

対象者：東北メディカル・メガバンク計画地域住民コホート調査参加者（宮城県）

測定：特定健診時に分注した尿検体を用いて測定した尿 Na/K 比

＜解析方法＞

研究デザイン：横断研究

曝露要因：尿 Na/K 比（田中式から推定 24 時間尿中 Na と K 排泄量を推定し、算出）

アウトカム：高血圧有病（特定健診時血圧値 $\geq 140/90\text{mmHg}$ あるいは自記式質問票で高血圧で現在通院中と回答ありの者と定義）

調整項目：性別、年齢（連続変数）、BMI（連続変数）、飲酒量（連続変数）、飲酒状況（連続変数ほとんど飲まない/飲めない・過去飲酒・1 合未満/日・1 合以上/日・欠損）

統計解析：下記解析について、全体・非肥満・肥満に分けて実施した

- ① 尿 Na/K 比值 1.0 上昇毎を基準とした 6 群に分類し、尿 Na/K 比 3.0 未満を基準とした場合の高血圧のオッズ比と 95% 信頼区間を多変量ロジスティック回帰分析で推定した。調整項目として、性別、年齢、BMI、飲酒状況を用いた。
- ② 収縮期血圧値を目的変数、尿 Na/K 比、性別、年齢、BMI、飲酒量を説明変数とした重回帰分析を実施した。
- ③ 尿 Na/K 比の高血圧に対する集団寄与危険割合（PAF）を算出した。

＜対象 2＞

対象者：宮城県登米市特定健診受診者

測定：特定健診時にナトリウム計を用いて尿 Na/K 比を測定した

統計解析：高血圧有病のオッズ比を尿 Na/K 比（3.0 未満を基準）レベルごとに分析した

- ① 肥満の有無による層別化解析を実施した。
- ② 収縮期血圧値を目的変数、尿 Na/K 比、性別、年齢、BMI、飲酒量を説明変数とした重回帰分析を実施した。

令和 5 年度

＜対象 1＞

対象者：宮城県登米市特定健診参加者

測定：特定健診時にナトリウム計を用いて尿 Na/K 比を測定した

2017 年-2019 年の 3 年間連続で特定健診を受診した 11,268 名を解析対象者とした
解析方法：

研究デザイン：縦断研究

調整項目：性別、年齢（連続変数）、BMI（ kg/m^2 、連続変数）、飲酒量（連続変数）

統計解析：前年と後年の収縮期血圧変化（後年－前年）を従属変数、前年の性・年齢・BMI 変化（後年－前年）、飲酒量変化

(後年—前年)、尿 Na/K 比変化 (後年—前年) を説明変数とした重回帰分析を実施した。

全集団・非肥満者・肥満者の3群での分析を実施した。なお飲酒量* (gou/日、連続変数) は飲酒頻度と1日あたりの飲酒量を掛け合わせて7で除した。また、降圧薬を服用していない者でのサブ解析も実施した。

<対象2>

対象者：宮城県大崎市特定健診参加者

測定：特定健診時に尿 Na/K 比を測定

2021年-2023年の3年間連続で特定健診を受診した8,313名を解析対象とした

解析方法：

研究デザイン：縦断研究

統計解析：前年と後年の収縮期血圧変化 (後年—前年) を従属変数、前年の性・年齢・BMI 変化 (後年—前年)、飲酒量変化 (後年—前年)、尿 Na/K 比変化 (後年—前年) を説明変数とした重回帰分析を実施した。なお飲酒量* (gou/日、連続変数) は飲酒頻度と1日あたりの飲酒量を掛け合わせて7で除した。また、降圧薬を服用していない者でのサブ解析も実施した。

(倫理面への配慮)

いずれの研究においても東北大学東北メディカル・メガバンク機構の倫理委員会の承認を得て実施している。

C. 研究結果

令和4年度

<対象1>

東北メディカル・メガバンク計画地域住民
コホート宮城県対象

東北メディカル・メガバンク計画の地域住民コホートにおいて宮城県の特定健診会場で受診した40,433人のうち、必要な情報

が網羅されている集団は32,126名であった。

表1-1に32,126名の尿 Na/K 比ごとの特性を示す。尿 Na/K 比と年齢に大きな違いはないが、値が大きい群ほど男性の割合が多く BMI は高かった。高血圧の有病率は3.0未満 (38.1%) と比べ7.0以上 (56.5%) で18%ほど高かった。表1-2、表1-3はそれぞれ非肥満者と肥満者における特性の違いを示す。層別化すると尿 Na/K 比と BMI の関連は明瞭ではなくなった。尿 Na/K 比と高血圧の関連は非肥満・肥満両群で同様に観察された。

表1-4に全体・非肥満・肥満に分けた尿 Na/K 比と高血圧有病のオッズ比を示す。すべての群で尿 Na/K 比の上昇とともに高血圧有病のオッズ比は上昇した (P for trend <0.01)。その関連は肥満の有無で層別化しても不変であったが、PAF は非肥満者で6.3%と肥満者 (3.7%) よりも多かった。

重回帰分析の結果、尿 Na/K 比と収縮期血圧の関連は年齢・性・飲酒量・BMI と独立に関連していた (表1-5)。

<対象2>

宮城県登米市特定健診参加者 (2017、
2018、2019 年度健診結果)

登米市では例年15,000人ほどの対象者が特定健診を受診するがそのほぼ全員が尿 Na/K 比測定を実施していた (図1)。

表1-6、1-7、1-8に2017、2018、2019年度の尿 Na/K 比ごとの特性を示す。すべての年度において尿 Na/K 比が高い群ほど男性の割合が多く BMI は高かった。高血圧の有病率は値が大きい群ほど高かった。

表1-9に全体・非肥満・肥満に分けた尿 Na/K 比と高血圧有病のオッズ比を示す。すべての年度のすべての群で尿 Na/K 比の上昇とともに高血圧有病のオッズ比は上昇した (P for trend <0.01)。その関連は肥満の有無で層別化しても不変であった。PAF は

2019 年度を除いて非肥満者で肥満者よりも大きい傾向であった。

表 1-10 に収縮期血圧値を目的変数、尿 Na/K 比、性別、年齢、BMI、飲酒量を説明変数とした重回帰分析の結果を示す。

表 1-5 と同様、尿 Na/K 比と収縮期血圧の関連は年齢・性・飲酒量・BMI と独立に関連していたことが認められた。

令和 5 年度

＜対象 1＞

宮城県登米市特定健診参加者

表 2-1 に 2017 年-2018 年の変化、2018 年-2019 年の変化、2017 年-2019 年の変化について分析結果を示す。

全集団において尿 Na/K 比変化は収縮期血圧の変化と関連していた。BMI の変化、尿 Na/K 比変化がすべて収縮期血圧変化と関連しており、飲酒量の変化も 2017 年-2018 年、2018 年-2019 年で統計学的に有意な正の関連（飲酒量が増えると収縮期血圧が上がる）が認められている。尿 Na/K 比の変化と収縮期血圧変化は肥満者と非肥満者双方で観察された。尿 Na/K 比の変化はむしろ肥満者で収縮期血圧変化と強く関連していた。

さらに血圧変化、尿 Na/K 比変化は降圧薬の影響を受けることから前後年いずれも降圧薬を服用していない集団での解析も追加している（表 2-2）。

降圧薬服用者を除外した解析でも尿 Na/K 比変化は収縮期血圧変化と正の関連を示している。

＜対象 2＞

宮城県大崎市特定健診参加者

同様に 2021 年-2022 年の変化、2022 年-2023 年の変化、2021 年-2023 年の変化についての解析を大崎市の集団においても実施した（表 2-3）。登米市の結果と同様に全集団において尿 Na/K 比変化は収縮期

血圧の変化と関連していた。BMI の変化、尿 Na/K 比変化がすべて収縮期血圧変化と関連しており、飲酒量の変化も統計学的に有意な正の関連（飲酒量が増えると収縮期血圧が上がる）が認められている。

これらの関連は登米市同様、降圧薬服用者を除いた解析でも観察された（表 2-4）。

D. 考察

令和 4 年度

尿 Na/K 比と高血圧の関連は 2 つのフィールドで観察され、減塩増野菜の普及は一般集団の肥満の有無に関わらず血圧低下に有用であることが再確認された。しかしながら PAF は概ね非肥満群の方が大きかった。特定保健指導において対象とならない非肥満の高血圧者に減塩・増野菜を意識づけることは健診結果の有効活用及び高血圧の重症化予防につながると考える。

令和 5 年度

尿 Na/K 比変化と収縮期血圧変化の関連は肥満の有無に関わらず同様に観察された。この関連は降圧薬非服用者に絞った解析でも同様に観察されており、尿 Na/K 比を下げるような生活変容が起きた集団で収縮期血圧を下げることが示された。

さらにこの関連は、複数年度にまたがっても、また別集団でも同様に観察されており、地域住民集団に一般化できる結果であると考ええる。

肥満者・非肥満者に関わらず尿 Na/K 比変化が重要であるということから、保健指導の現場において肥満者に対しては減量だけでなく尿 Na/K 比変化を意識した指導を、また、非肥満者に対しても尿 Na/K 比変化を意識するような指導が有用な可能性がある。また、今回のデータより非肥満者においても体重

が減少した者で収縮期血圧が下がっていることが明らかとなり、肥満予防も併せて意識した生活を送ることの重要性が示された。

尿 Na/K 比の健診・保健指導での活用法についての引き続きの検討が重要である。

E. 結論

肥満・非肥満に関わらず尿 Na/K 比が高血圧と関連することが明らかとなった。

現在、特定保健指導では非肥満の高血圧に対する指導がなく、この集団における尿 Na/K 比測定と指導が有用である可能性がある。また、肥満者に対する保健指導の場においても減量だけでなく尿 Na/K 比を意識するような指導が有用である可能性も示された。一方、対象者の選定にもコストがかかることから健診受診者全員に測定する利益・不利益、対象者を絞った測定を行う利益・不利益についても十分な検討が必要となる。

F. 健康危機情報

なし

G. 研究発表

1. 論文発表

なし

2. 学会発表

小暮真奈. 肥満の有無に着目した尿ナトリウム/カリウム (Na/K) 比と高血圧有病率との関連. 第 35 回血圧管理研究会 (京都). 2023 年

H. 知的所有権の取得状況

1. 特許取得

なし

2. 実用新案登録

なし

3. その他

なし

参考文献

- (1) 日本高血圧学会 (2019 年発行) ライフサイエンス出版日本高血圧ガイドライン 2019.
- (2) Sacks FM, et al. Effects on Blood Pressure of Reduced Dietary Sodium and the Dietary Approaches to Stop Hypertension (DASH) Diet. New N Engl J Med 2001; 344:3-10.

表 1-1. Participants' baseline characteristics according to urinary Na/K ratio (overall)

	urinary Na/K ratio (overall, n=32,126)					
	< 3.0	3.0 - 3.9	4.0 - 4.9	5.0 - 5.9	6.0 - 6.9	7.0 ≤
Number	4,067	11,254	10,523	4,750	1,210	322
Age (year) (mean ± SD)	58.5 ± 11.6	58.9 ± 11.7	59.2 ± 11.9	59.5 ± 11.8	58.8 ± 12.4	58.4 ± 12.9
Sex (number, %)						
Men	1,329 (32.7)	3,973 (35.3)	4,191 (39.8)	2,063 (43.4)	551 (45.5)	177 (55.0)
Women	2,738 (67.3)	7,281 (64.7)	6,332 (60.2)	2,687 (56.6)	659 (54.5)	145 (45.0)
BMI (mean ± SD)	23.0 ± 3.6	23.3 ± 3.5	23.4 ± 3.5	23.5 ± 3.5	23.6 ± 3.7	23.7 ± 3.5
Urinary Na/K ratio (mean ± SD)	2.62 ± 0.32	3.53 ± 0.28	4.46 ± 0.28	5.40 ± 0.28	6.39 ± 0.27	7.60 ± 0.64
SBP (mmHg) (mean ± SD)	122.5 ± 16.8	125.0 ± 17.0	126.6 ± 17.2	128.1 ± 17.5	129.3 ± 18.0	130.6 ± 17.7
DBP (mmHg) (mean ± SD)	74.2 ± 10.6	75.3 ± 10.8	76.0 ± 10.8	76.9 ± 10.9	78.3 ± 11.7	79.3 ± 11.2
Obesity (number, %)						
Non-obese (<25.0 kg/m ²)	3,251 (79.9)	8,623 (76.6)	7,715 (73.3)	3,427 (72.2)	830 (68.6)	218 (67.7)
Obese (≥25.0 kg/m ²)	816 (20.1)	2,631 (23.4)	2,808 (26.7)	1,323 (27.9)	380 (31.4)	104 (32.3)
Hypertension[*] (number, %)	1,548 (38.1)	4,422 (39.3)	4,434 (42.1)	2,189 (46.1)	594 (49.1)	182 (56.5)
Smoking status (number, %)						
Current-smoker	531 (13.1)	1,533 (13.6)	1,602 (15.2)	698 (14.7)	163 (13.5)	46 (14.3)
Ex-smoker	938 (23.1)	2,613 (23.2)	2,625 (25.0)	1,292 (27.2)	358 (29.6)	128 (39.8)
Non-smoker	2,525 (62.1)	6,915 (61.4)	6,101 (58.0)	2,663 (56.1)	671 (55.5)	142 (44.1)
Unknown	73 (1.8)	193 (1.7)	195 (1.9)	97 (2.0)	18 (1.5)	6 (1.9)
Drinking status (number, %)						
<23 g/day	1,713 (42.1)	4,732 (42.1)	4,434 (42.1)	1,968 (41.4)	524 (43.3)	140 (43.5)
≥23 g/day	430 (10.6)	1,127 (10.0)	1,158 (11.0)	579 (12.2)	165 (13.6)	57 (17.7)
Ex-drinker	111 (2.7)	308 (2.7)	249 (2.4)	120 (2.5)	37 (3.1)	11 (3.4)
Never-drinker	1,792 (44.1)	5,019 (44.6)	4,628 (44.0)	2,052 (43.2)	481 (39.8)	112 (34.8)
Unknown	21 (0.5)	68 (0.6)	54 (0.5)	31 (0.7)	3 (0.3)	2 (0.6)

Abbreviations: BMI, body mass index ; Na/K, sodium potassium ratio; SBP, systolic blood pressure; DBP, diastolic blood pressure

*Hypertension was defined as an SBP≥140mmHg and/or a DBP≥90 mmHg or under treatment for hypertension.

表 1-2. Participants' baseline characteristics according to urinary Na/K ratio (non-obese)

	urinary Na/K ratio (n=24,064)					
	< 3.0	3.0 - 3.9	4.0 - 4.9	5.0 - 5.9	6.0 - 6.9	7.0 ≤
Number	3,251	8,623	7,715	3,427	830	218
Age (year) (mean ± SD)	58.0 ± 11.6	58.2 ± 11.9	58.5 ± 12.2	58.8 ± 12.3	57.6 ± 12.9	57.9 ± 13.5
Sex (number, %)						
Men	922 (28.4)	2,671 (31.0)	2,754 (35.7)	1,352 (39.5)	350 (42.2)	122 (56.0)
Women	2,329 (71.6)	5,952 (69.0)	4,961 (64.3)	2,075 (60.6)	480 (57.8)	96 (44.0)
BMI (mean ± SD)	21.8 ± 2.8	22.0 ± 2.6	21.9 ± 2.4	21.9 ± 2.3	21.7 ± 2.4	21.7 ± 2.4
Urinary Na/K ratio (mean ± SD)	2.62 ± 0.32	3.53 ± 0.28	4.46 ± 0.28	5.40 ± 0.27	6.39 ± 0.27	7.61 ± 0.69
SBP (mmHg) (mean ± SD)	120.8 ± 16.6	123.4 ± 17.0	124.8 ± 17.3	126.2 ± 17.6	127.5 ± 18.3	129.2± 18.3
DBP (mmHg) (mean ± SD)	73.2 ± 10.4	74.3 ± 10.8	74.9± 10.8	75.7 ± 10.9	77.2 ± 11.6	78.0 ± 11.6
Hypertension[*] (number, %)	1,058 (32.5)	2,854 (33.1)	2,711 (35.1)	1,330 (38.8)	350 (42.2)	107 (49.1)
Smoking status (number, %)						
Current-smoker	427 (13.1)	1,159 (13.4)	1,168 (15.1)	512 (14.9)	129 (15.5)	35 (16.1)
Ex-smoker	681 (21.0)	1,842 (21.4)	1,789 (23.2)	852 (24.9)	227 (27.4)	87 (39.9)
Non-smoker	2,091 (64.3)	5,493 (63.7)	4,629 (60.0)	1,999 (58.3)	463 (55.8)	90 (41.3)
Unknown	52 (1.6)	129 (1.5)	129 (1.7)	64 (1.9)	11 (1.3)	6 (2.8)
Drinking status (number, %)						
<23 g/day	1,360 (41.8)	3,615 (41.9)	3,267 (42.4)	1,399 (40.8)	369 (44.5)	94 (43.1)
≥23 g/day	334 (10.3)	823 (9.5)	831 (10.8)	418 (12.2)	107 (12.9)	41 (18.8)
Ex-drinker	82 (2.5)	225 (2.6)	165 (2.1)	87 (2.5)	26 (3.1)	8 (3.7)
Never-drinker	1,456 (44.8)	3,910 (45.3)	3,416 (44.3)	1,504 (43.9)	327 (39.4)	73 (33.5)
Unknown	19 (0.6)	50 (0.6)	36 (0.5)	19 (0.6)	1 (0.1)	2 (0.9)

Abbreviations: BMI, body mass index ; Na/K, sodium potassium ratio; IQR, interquartile range; SBP, systolic blood pressure; DBP, diastolic blood pressure

*Hypertension was defined as an SBP≥140mmHg and/or a DBP≥90 mmHg or under treatment for hypertension.

表 1-3. Participants' baseline characteristics according to urinary Na/K ratio (obese)

	urinary Na/K ratio (n=8,062)					
	< 3.0	3.0 - 3.9	4.0 - 4.9	5.0 - 5.9	6.0 - 6.9	7.0 ≤
Number	816	2,631	2,808	1,323	380	104
Age (year) (mean ± SD)	60.8 ± 11.3	61.2 ± 10.8	61.1 ± 10.9	61.4 ± 10.3	61.4 ± 10.9	59.5 ± 11.7
Sex (number, %)						
Men	407 (49.9)	1,302 (49.5)	1,437 (51.2)	711 (53.7)	201 (52.9)	55 (52.9)
Women	409 (50.1)	1,329 (50.5)	1,371 (48.8)	612 (46.3)	179 (47.1)	49 (47.1)
BMI (mean ± SD)	27.7 ± 2.7	27.7 ± 2.6	27.7 ± 2.5	27.7 ± 2.5	27.7 ± 2.7	27.7 ± 2.2
Urinary Na/K ratio (mean ± SD)	2.64 ± 0.31	3.54 ± 0.28	4.48 ± 0.28	5.41 ± 0.28	6.37 ± 0.26	7.59 ± 0.53
SBP (mmHg) (mean ± SD)	129.1 ± 16.1	130.5 ± 15.9	131.5 ± 15.8	132.9 ± 16.5	133.2 ± 16.6	133.6± 15.9
DBP (mmHg) (mean ± SD)	78.5 ± 10.1	78.6 ± 10.2	79.2 ± 10.3	80.0 ± 10.3	80.7 ± 11.4	82.0 ± 10.0
Hypertension* (number, %)	490 (60.1)	1,568 (59.6)	1,723 (61.4)	859 (64.9)	244 (64.2)	75 (72.1)
Smoking status (number, %)						
Current-smoker	104 (12.8)	374 (14.2)	434 (15.5)	186 (14.1)	34 (9.0)	11 (10.6)
Ex-smoker	257 (31.5)	771 (29.3)	836 (29.8)	440 (33.3)	131 (34.5)	41 (39.4)
Non-smoker	434 (53.2)	1,422 (54.1)	1,472 (52.4)	664 (50.2)	208 (54.7)	52 (50.0)
Unknown	21 (2.6)	64 (2.4)	66 (2.4)	33 (2.5)	7 (1.8)	0 (0.0)
Drinking status (number, %)						
<23 g/day	353 (43.3)	1,117 (42.5)	1,167 (41.6)	569 (43.0)	155 (40.8)	46 (44.2)
≥23 g/day	96 (11.8)	304 (11.6)	327 (11.7)	161 (12.2)	58 (15.3)	16 (15.4)
Ex-drinker	29 (3.6)	83 (3.2)	84 (3.0)	33 (2.5)	11 (2.9)	3 (2.9)
Never-drinker	336 (41.2)	1,109 (42.2)	1,212 (43.2)	548 (41.4)	154 (40.5)	39 (37.5)
Unknown	2 (0.3)	18 (0.7)	18 (0.6)	12 (0.9)	2 (0.5)	0 (0.0)

Abbreviations: BMI, body mass index ; Na/K, sodium potassium ratio; SBP, systolic blood pressure; DBP, diastolic blood pressure
 *Hypertension was defined as an SBP≥140mmHg and/or a DBP≥90 mmHg or under treatment for hypertension.

表 1-4. Relationship between the urinary Na/K ratio and hypertension

Overall (n=32,126)		Odds ratio, 95% CI			Non-obese (n=24,064)		Odds ratio, 95% CI			Obese (n=8,062)		Odds ratio, 95% CI		
Age	per 1 year	1.09	1.09	1.09	Age	per 1 year	1.09	1.08	1.09	Age	per 1 year	1.09	1.08	1.09
Women	vs. men	0.88	0.83	0.93	Women	vs. men	0.79	0.74	0.84	Women	vs. men	0.91	0.81	1.02
Urinary Na/K ratio	< 3.0		1.00 (ref)		Urinary Na/K ratio	< 3.0		1.00 (ref)		Urinary Na/K ratio	< 3.0		1.00 (ref)	
	3.0-3.9	0.97	0.89	1.06		3.0-3.9	1.00	0.91	1.09		3.0-3.9	0.95	0.79	1.13
	4.0-4.9	1.06	0.97	1.15		4.0-4.9	1.05	0.96	1.15		4.0-4.9	1.03	0.87	1.23
	5.0-5.9	1.24	1.12	1.36		5.0-5.9	1.21	1.09	1.35		5.0-5.9	1.20	0.99	1.47
	6.0-6.9	1.49	1.28	1.73		6.0-6.9	1.54	1.30	1.83		6.0-6.9	1.16	0.88	1.52
	7.0-	2.17	1.66	2.85		7.0-	1.98	1.45	2.70		7.0-	2.15	1.30	3.56
	P for trend	< 0.01				P for trend	< 0.01				P for trend	< 0.01		
Drinking status	Never-drinker		1.00		Drinking status	Never-drinker		1.00		Drinking status	Never-drinker		1.00	
	Ex-drinker	1.04	0.88	1.22		Ex-drinker	0.89	0.73	1.09		Ex-drinker	1.48	1.09	2.01
	<23 g/day	1.17	1.11	1.24		<23 g/day	1.17	1.09	1.25		<23 g/day	1.05	0.94	1.18
	≥23 g/day	1.57	1.43	1.73		≥23 g/day	1.51	1.36	1.67		≥23 g/day	1.47	1.23	1.76
	Unknown	1.41	1.01	1.96		Unknown	1.46	1.00	2.13		Unknown	1.53	0.79	2.95
BMI	per 1 kg/m ²	1.21	1.20	1.21										
PAF		6.2%			PAF		6.3%			PAF		3.7%		

Abbreviations: BMI, body mass index ; Na/K, sodium potassium ratio; 95% CI, 95% confidence interval

表 1-5. Relationship between the urinary Na/K ratio and SBP using multiple regression analyses adjusted for age, sex, BMI, and alcohol intake

Overall (n=32,126)				Non-obese (n=24,064)				Obese (n=8,062)			
SBP		β	P value	SBP		β	P value	SBP		β	P value
Age (per 1 year)		0.39	< 0.01	Age (per 1 year)		0.42	< 0.01	Age (per 1 year)		0.28	< 0.01
Women (vs. men)		-1.09	< 0.01	Women (vs. men)		-1.16	< 0.01	Women (vs. men)		-0.46	0.21
Alcohol intake (per 1 g/day)		0.07	< 0.01	Alcohol intake (per 1 g/day)		0.07	< 0.01	Alcohol intake (per 1 g/day)		0.06	< 0.01
BMI (per 1 kg/m ²)		1.12	< 0.01	BMI (per 1 kg/m ²)		1.37	< 0.01	BMI (per 1 kg/m ²)		0.86	< 0.01
Urinary Na/K ratio (per 1 unit)		1.47	< 0.01	Urinary Na/K ratio (per 1 unit)		1.61	< 0.01	Urinary Na/K ratio (per 1 unit)		1.16	< 0.01

Abbreviations: BMI, body mass index; Na/K ratio, sodium/potassium ratio; SBP, systolic blood pressure

表 1-6 . Characteristics of study participants, Tome Na/K Measuring Project in 2017

Na/K ratio in 2017 (overall)	0.0-0.9	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-
n	61	654	1,836	2,642	2,844	2,285	1,729	1,143	715	399	1,033
Age (years) ^a	62.0 ± 16.5	60.5 ± 16.1	62.9 ± 15.5	64.0 ± 14.9	65.5 ± 14.0	66.1 ± 13.7	66.1 ± 13.9	65.7 ± 14.1	64.9 ± 14.1	65.0 ± 13.6	65.3 ± 14.3
Sex ^b											
Men	35 (57.4)	323 (49.4)	824 (44.9)	1,221 (46.2)	1,286 (45.2)	1,058 (46.3)	826 (47.8)	580 (50.7)	382 (53.4)	232 (58.2)	613 (59.3)
Women	26 (42.6)	331 (50.6)	1,012 (55.1)	1,421 (53.8)	1,558 (54.8)	1,227 (53.7)	903 (52.2)	563 (49.3)	333 (46.6)	167 (41.9)	420 (40.7)
BMI (kg/m ²) ^a	23.8 ± 4.6	23.5 ± 3.6	23.6 ± 3.8	23.7 ± 3.6	23.7 ± 3.6	23.7 ± 3.7	23.7 ± 3.5	24.0 ± 3.8	24.1 ± 4.0	24.1 ± 3.9	24.0 ± 3.7
UrinaryNa/K ratio ^a	0.73 ± 0.19	1.58 ± 0.26	2.50 ± 0.28	3.46 ± 0.28	4.45 ± 0.29	5.43 ± 0.28	6.43 ± 0.29	7.42 ± 0.29	8.40 ± 0.29	9.43 ± 0.29	13.37 ± 3.19
SBP (mmHg) ^a	122.7 ± 15.8	128.1 ± 17.4	128.5 ± 18.1	130.1 ± 17.7	131.8 ± 17.8	132.4 ± 18.1	133.4 ± 18.4	134.5 ± 18.0	134.0 ± 18.2	136.9 ± 17.8	136.9 ± 19.5
DBP (mmHg) ^a	69.9 ± 10.6	72.9 ± 11.0	73.1 ± 11.1	73.7 ± 10.9	74.4 ± 10.9	74.7 ± 11.4	75.3 ± 11.2	76.1 ± 11.1	76.0 ± 11.6	78.6 ± 11.9	78.1 ± 12.3
Obesity (number, %)											
Non-obese (<25.0 kg/m ²)	41 (67.2)	454 (69.4)	1,263 (68.8)	1,790 (67.8)	1,927 (67.8)	1,540 (67.4)	1,162 (67.2)	744 (65.1)	447 (62.5)	257 (64.4)	657 (63.6)
Obese (≥25.0 kg/m ²)	20 (32.8)	200 (30.6)	573 (31.2)	852 (32.3)	917 (32.2)	745 (32.6)	567 (32.8)	399 (34.9)	268 (37.5)	142 (35.6)	376 (36.4)
Hypertension ^b	28 (45.9)	300 (45.9)	834 (45.4)	1,299 (49.2)	1,471 (51.7)	1,244 (54.4)	956 (55.3)	680 (59.5)	411 (57.5)	264 (66.2)	682 (66.0)
Habitual smoker ^b	20 (32.8)	168 (25.7)	340 (18.5)	441 (16.7)	428 (15.1)	312 (13.7)	238 (13.8)	186 (16.3)	126 (17.6)	69 (17.3)	143 (13.8)
Drinking status ^b											
Non drinker	33 (54.1)	355 (54.3)	1,023 (55.7)	1,494 (56.6)	1,594 (56.1)	1,271 (55.6)	959 (55.5)	593 (51.9)	353 (49.4)	197 (49.4)	517 (50.1)
Alcohol < 1 drink/day	11 (18.0)	162 (24.8)	496 (27.0)	707 (26.8)	745 (26.2)	589 (25.8)	493 (28.5)	320 (28.0)	203 (28.4)	96 (24.1)	289 (28.0)
Alcohol 1-2 drink/day	13 (21.3)	98 (15.0)	220 (12.0)	310 (11.7)	352 (12.4)	330 (14.4)	203 (11.8)	159 (13.9)	101 (14.1)	72 (18.1)	163 (15.8)
Alcohol 2- drink/day	4 (6.6)	39 (6.0)	97 (5.3)	131 (5.0)	153 (5.4)	95 (4.2)	73 (4.2)	71 (6.2)	58 (8.1)	34 (8.5)	64 (6.2)
User of antihypertensive Medication ^b	25 (41.0)	226 (34.6)	639 (34.8)	958 (36.3)	1,079 (37.9)	893 (39.1)	694 (40.1)	485 (42.4)	287 (40.1)	187 (46.9)	472 (45.7)
Na/K ratio in 2017 (non-obese)	0.0-0.9	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-
n	41	454	1,263	1,790	1,927	1,540	1,162	744	447	257	657
Age (years) ^a	61.0 ± 17.2	59.8 ± 16.4	62.6 ± 15.9	63.9 ± 15.2	65.6 ± 14.2	66.1 ± 13.7	65.7 ± 14.4	65.2 ± 14.7	65.8 ± 13.7	65.2 ± 13.5	65.7 ± 14.2
Sex ^b											
Men	26 (63.4)	226 (49.8)	542 (42.9)	779 (43.5)	826 (42.9)	678 (44.0)	521 (44.8)	366 (49.2)	227 (50.8)	145 (56.4)	391 (59.5)
Women	15 (36.6)	228 (50.2)	721 (57.1)	1,011 (56.5)	1,101 (57.1)	862 (56.0)	641 (55.2)	378 (50.8)	220 (49.2)	112 (43.6)	266 (40.5)
BMI (kg/m ²) ^a	21.3 ± 2.8	21.7 ± 2.1	21.7 ± 2.2	21.7 ± 2.1	21.7 ± 2.1	21.8 ± 2.1	21.8 ± 2.0	21.8 ± 2.0	21.7 ± 2.1	21.8 ± 2.1	21.8 ± 2.1
UrinaryNa/K ratio ^a	0.71 ± 0.20	1.58 ± 0.26	2.50 ± 0.28	3.46 ± 0.29	4.44 ± 0.29	5.43 ± 0.29	6.43 ± 0.28	7.41 ± 0.29	8.39 ± 0.29	9.41 ± 0.29	13.29 ± 3.18
SBP (mmHg) ^a	122.8 ± 15.9	126.1 ± 18.5	126.2 ± 18.4	127.5 ± 17.4	129.7 ± 17.9	130.5 ± 18.3	131.1 ± 18.7	131.9 ± 18.5	131.4 ± 18.3	134.8 ± 18.9	134.8 ± 19.8
DBP (mmHg) ^a	69.3 ± 10.8	71.5 ± 10.8	71.5 ± 10.8	71.9 ± 10.6	73.0 ± 10.8	73.4 ± 11.3	73.8 ± 10.9	74.2 ± 11.0	73.7 ± 11.3	77.2 ± 12.6	76.7 ± 12.0
Hypertension ^b	17 (41.5)	181 (39.9)	477 (37.8)	754 (42.1)	889 (46.1)	757 (49.2)	556 (47.9)	380 (51.1)	226 (50.6)	146 (56.8)	402 (61.2)
Habitual smoker ^b	16 (39.0)	125 (27.5)	245 (19.4)	311 (17.4)	291 (15.1)	221 (14.4)	169 (14.5)	131 (17.6)	74 (16.6)	41 (16.0)	98 (14.9)
Drinking status ^b											
Non drinker	19 (46.3)	239 (52.6)	698 (55.3)	1,036 (57.9)	1,101 (57.1)	848 (55.1)	654 (56.3)	384 (51.6)	213 (47.7)	135 (52.5)	310 (47.2)
Alcohol < 1 drink/day	9 (22.0)	116 (25.6)	349 (27.6)	480 (26.8)	498 (25.8)	421 (27.3)	330 (28.4)	222 (29.8)	137 (30.7)	61 (23.7)	206 (31.4)
Alcohol 1-2 drink/day	11 (26.8)	68 (15.0)	154 (12.2)	186 (10.4)	223 (11.6)	210 (13.6)	129 (11.1)	101 (13.6)	64 (14.3)	39 (15.2)	99 (15.1)
Alcohol 2- drink/day	2 (4.9)	31 (6.8)	62 (4.9)	88 (4.9)	105 (5.5)	61 (4.0)	48 (4.1)	37 (5.0)	33 (7.4)	22 (8.6)	42 (6.4)
User of antihypertensive Medication ^b	14 (34.2)	134 (29.5)	360 (28.5)	550 (30.7)	632 (32.8)	526 (34.2)	389 (33.5)	256 (34.4)	158 (35.4)	93 (36.2)	267 (40.6)
Na/K ratio in 2017 (obese)	0.0-0.9	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-
n	20	200	573	852	917	745	567	399	268	142	376
Age (years) ^a	64.0 ± 15.1	62.2 ± 15.4	63.5 ± 14.7	64.3 ± 14.3	65.2 ± 13.6	66.2 ± 13.6	66.9 ± 12.4	66.6 ± 12.7	63.4 ± 14.7	64.6 ± 13.6	64.5 ± 14.5
Sex ^b											
Men	9 (45.0)	97 (48.5)	282 (49.2)	442 (51.9)	460 (50.2)	380 (51.0)	305 (53.8)	214 (53.6)	155 (57.8)	87 (61.3)	222 (59.0)
Women	11 (55.0)	103 (51.5)	291 (50.8)	410 (48.1)	457 (49.8)	365 (49.0)	262 (46.2)	185 (46.4)	113 (42.2)	55 (38.7)	154 (41.0)
BMI (kg/m ²) ^a	28.9 ± 2.7	27.6 ± 2.8	27.9 ± 3.1	27.7 ± 2.8	27.7 ± 2.7	27.7 ± 2.9	27.6 ± 2.4	28.0 ± 2.9	28.0 ± 3.1	28.2 ± 2.8	27.8 ± 2.7
UrinaryNa/K ratio ^a	0.76 ± 0.17	1.58 ± 0.26	2.50 ± 0.28	3.47 ± 0.28	4.46 ± 0.29	5.42 ± 0.28	6.44 ± 0.29	7.43 ± 0.29	8.40 ± 0.30	9.45 ± 0.30	13.51 ± 3.21
SBP (mmHg) ^a	122.7 ± 16.1	132.9 ± 13.6	133.5 ± 16.4	135.4 ± 17.2	136.2 ± 16.8	136.5 ± 17.0	138.1 ± 16.9	139.3 ± 15.9	138.2 ± 17.3	140.8 ± 15.1	140.5 ± 18.5
DBP (mmHg) ^a	71.1 ± 10.1	76.5 ± 9.9	76.7 ± 11.0	77.3 ± 10.7	77.4 ± 10.5	77.4 ± 11.2	78.2 ± 11.0	79.6 ± 10.5	79.7 ± 11.2	81.1 ± 10.1	80.5 ± 12.5
Hypertension ^b	11 (55.0)	119 (59.5)	357 (62.3)	545 (64.0)	582 (63.5)	487 (65.4)	400 (70.6)	300 (75.2)	185 (69.0)	118 (83.1)	280 (74.5)
Habitual smoker ^b	4 (20.0)	43 (21.5)	95 (16.6)	130 (15.3)	137 (14.9)	91 (12.2)	69 (12.2)	55 (13.8)	52 (19.4)	28 (19.7)	45 (12.0)
Drinking status ^b											
Non drinker	14 (70.0)	116 (58.0)	325 (56.7)	458 (53.8)	493 (53.8)	423 (56.8)	305 (53.8)	209 (52.4)	140 (52.2)	62 (43.7)	207 (55.1)
Alcohol < 1 drink/day	2 (10.0)	46 (23.0)	147 (25.7)	227 (26.6)	247 (26.9)	168 (22.6)	163 (28.8)	98 (24.6)	66 (24.6)	35 (24.7)	83 (22.1)
Alcohol 1-2 drink/day	2 (10.0)	30 (15.0)	66 (11.5)	124 (14.6)	129 (14.1)	120 (16.1)	74 (13.1)	58 (14.5)	37 (13.8)	33 (23.2)	64 (17.0)
Alcohol 2- drink/day	2 (10.0)	8 (4.0)	35 (6.1)	43 (5.1)	48 (5.2)	34 (4.6)	25 (4.4)	34 (8.5)	25 (9.3)	12 (8.5)	22 (5.9)
User of antihypertensive Medication ^b	11 (55.0)	92 (46.0)	279 (48.7)	408 (47.9)	447 (48.8)	367 (49.3)	305 (53.8)	229 (57.4)	129 (48.1)	94 (66.2)	205 (54.5)

^a Means ± SD

^b Number, %

BMI, body mass index; DBP, diastolic blood pressure; Na/K ratio, sodium/potassium ratio; SBP, systolic blood pressure

表 1-7. Characteristics of study participants, Tome Na/K Measuring Project in 2018

Na/K ratio in 2018 (overall)		0.0-0.9	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-
n		60	675	1,902	2,976	3,098	2,453	1,606	957	541	341	462
Age (years) ^a		61.1 ± 16.2	62.4 ± 16.0	64.2 ± 14.6	65.2 ± 14.3	66.1 ± 14.0	65.9 ± 14.0	66.3 ± 14.1	65.8 ± 14.0	64.6 ± 14.3	66.1 ± 13.5	64.4 ± 14.2
Sex ^b												
Men		34 (56.7)	318 (47.1)	858 (45.1)	1,363 (45.8)	1,417 (45.7)	1,196 (48.8)	825 (51.4)	502 (52.5)	297 (54.9)	203 (59.5)	286 (61.9)
Women		26 (43.3)	357 (52.9)	1,044 (54.9)	1,613 (54.2)	1,681 (54.3)	1,257 (51.2)	781 (48.6)	455 (47.5)	244 (45.1)	138 (40.5)	176 (38.1)
BMI (kg/m ²) ^a		22.9 ± 3.2	23.7 ± 3.9	23.8 ± 3.8	23.7 ± 3.7	23.6 ± 3.6	23.6 ± 3.7	24.0 ± 3.6	23.8 ± 3.7	24.1 ± 3.9	24.0 ± 3.6	24.2 ± 4.1
UrinaryNa/K ratio ^a		0.74 ± 0.20	1.59 ± 0.27	2.51 ± 0.28	3.47 ± 0.29	4.44 ± 0.29	5.42 ± 0.28	6.42 ± 0.28	7.42 ± 0.29	8.39 ± 0.28	9.42 ± 0.29	11.71 ± 1.83
SBP (mmHg) ^a		124.4 ± 17.2	127.9 ± 16.4	127.9 ± 16.6	129.3 ± 17.5	129.8 ± 16.9	131.9 ± 18.0	132.8 ± 17.9	133.4 ± 18.5	134.0 ± 17.9	135.8 ± 17.9	135.6 ± 18.2
DBP (mmHg) ^a		73.2 ± 12.8	74.9 ± 11.0	74.6 ± 10.7	74.7 ± 11.0	75.1 ± 10.5	76.1 ± 11.0	77.1 ± 11.3	76.9 ± 11.9	78.0 ± 11.3	78.7 ± 10.9	79.2 ± 11.2
Obesity (number, %)												
Non-obese (<25.0 kg/m ²)		44 (73.3)	466 (69.0)	1,260 (66.3)	2,017 (67.8)	2,105 (68.0)	1,684 (68.7)	1,017 (63.3)	628 (65.6)	349 (64.5)	217 (63.6)	291 (63.0)
Obese (≥25.0 kg/m ²)		16 (26.7)	209 (31.0)	642 (33.8)	959 (32.2)	993 (32.1)	769 (31.4)	589 (36.7)	329 (34.4)	192 (35.5)	124 (36.4)	171 (37.0)
Hypertension ^b		21 (35.0)	345 (51.1)	922 (48.5)	1,483 (49.8)	1,600 (51.7)	1,341 (54.7)	902 (56.2)	555 (58.0)	313 (57.9)	222 (65.1)	299 (64.7)
Habitual smoker ^b		17 (28.3)	128 (19.0)	352 (18.5)	484 (16.3)	429 (13.9)	362 (14.8)	228 (14.2)	133 (13.9)	85 (15.7)	57 (16.7)	77 (16.7)
Drinking status ^b												
Non drinker		32 (53.3)	389 (57.6)	1,067 (56.1)	1,666 (56.0)	1,710 (55.3)	1,319 (53.9)	853 (53.2)	491 (51.3)	276 (51.1)	157 (46.2)	218 (47.2)
Alcohol < 1 drink/day		14 (23.3)	168 (24.9)	502 (26.4)	764 (25.7)	847 (27.4)	682 (27.9)	443 (27.6)	266 (27.8)	137 (25.4)	92 (27.1)	118 (25.5)
Alcohol 1-2 drink/day		11 (18.3)	74 (11.0)	237 (12.5)	388 (13.1)	387 (12.5)	327 (13.4)	229 (14.3)	146 (15.3)	77 (14.3)	64 (18.8)	90 (19.5)
Alcohol 2- drink/day		3 (5.0)	44 (6.5)	96 (5.1)	156 (5.3)	150 (4.9)	121 (4.9)	80 (5.0)	54 (5.6)	50 (9.3)	27 (7.9)	36 (7.8)
User of antihypertensive Medication ^b		18 (30.0)	267 (39.6)	726 (38.2)	1,154 (38.8)	1,243 (40.1)	988 (40.3)	660 (41.1)	411 (43.0)	230 (42.5)	161 (47.2)	224 (48.5)

Na/K ratio in 2018 (non-obese)		0.0-0.9	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-
n		44	466	1,260	2,017	2,105	1,684	1,017	628	349	217	291
Age (years) ^a		61.6 ± 16.0	62.7 ± 16.0	63.8 ± 14.8	65.8 ± 14.2	66.2 ± 14.2	65.6 ± 14.3	66.5 ± 14.1	65.9 ± 14.1	65.4 ± 14.5	66.5 ± 13.4	65.2 ± 13.8
Sex ^b												
Men		26 (59.1)	211 (45.3)	541 (42.9)	873 (43.3)	906 (43.0)	785 (46.6)	493 (48.5)	303 (48.3)	186 (53.3)	132 (60.8)	187 (64.3)
Women		18 (40.9)	255 (54.7)	719 (57.1)	1,144 (56.7)	1,199 (57.0)	899 (53.4)	524 (51.5)	325 (51.8)	163 (46.7)	85 (39.2)	104 (35.7)
BMI (kg/m ²) ^a		21.4 ± 2.2	21.7 ± 2.1	21.7 ± 2.1	21.7 ± 2.1	21.7 ± 2.1	21.7 ± 2.1	21.9 ± 2.1	21.6 ± 2.0	21.9 ± 2.1	21.9 ± 2.0	21.7 ± 2.1
UrinaryNa/K ratio ^a		0.72 ± 0.21	1.59 ± 0.27	2.51 ± 0.28	3.48 ± 0.28	4.44 ± 0.29	5.42 ± 0.28	6.42 ± 0.28	7.41 ± 0.29	8.37 ± 0.28	9.42 ± 0.29	11.78 ± 1.88
SBP (mmHg) ^a		121.7 ± 17.3	126.6 ± 17.4	125.7 ± 16.6	127.4 ± 17.4	128.2 ± 17.3	129.9 ± 18.1	130.6 ± 18.3	131.7 ± 18.7	132.2 ± 18.3	133.7 ± 17.5	134.3 ± 19.4
DBP (mmHg) ^a		72.5 ± 13.3	73.9 ± 11.0	73.1 ± 10.7	73.3 ± 10.8	73.9 ± 10.4	74.9 ± 10.7	75.8 ± 11.4	75.3 ± 11.6	76.4 ± 10.9	77.5 ± 10.8	78.1 ± 11.6
Hypertension ^b		13 (29.6)	213 (45.7)	509 (40.4)	869 (43.1)	959 (45.6)	816 (48.5)	497 (48.9)	316 (50.3)	182 (52.2)	132 (60.8)	171 (58.8)
Habitual smoker ^b		15 (34.1)	89 (19.1)	259 (20.6)	335 (16.6)	298 (14.2)	263 (15.6)	139 (13.7)	81 (12.9)	53 (15.2)	33 (15.2)	54 (18.6)
Drinking status ^b												
Non drinker		19 (43.2)	264 (56.7)	692 (54.9)	1,126 (55.9)	1,176 (56.0)	913 (54.4)	559 (55.0)	333 (53.0)	174 (49.9)	91 (42.1)	134 (46.1)
Alcohol < 1 drink/day		13 (29.6)	119 (25.5)	349 (27.7)	527 (26.1)	589 (28.0)	464 (27.6)	275 (27.1)	176 (28.0)	100 (28.7)	61 (28.2)	75 (25.8)
Alcohol 1-2 drink/day		9 (20.5)	57 (12.2)	158 (12.5)	252 (12.5)	236 (11.2)	217 (12.9)	139 (13.7)	86 (13.7)	47 (13.5)	45 (20.8)	54 (18.6)
Alcohol 2- drink/day		3 (6.8)	26 (5.6)	61 (4.8)	111 (5.5)	101 (4.8)	86 (5.1)	43 (4.2)	33 (5.3)	28 (8.0)	19 (8.8)	28 (9.6)
User of antihypertensive Medication ^b		11 (25.0)	160 (34.3)	385 (30.6)	655 (32.5)	743 (35.3)	565 (33.6)	353 (34.7)	225 (35.8)	127 (36.4)	97 (44.7)	127 (43.6)

Na/K ratio in 2018 (obese)		0.0-0.9	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-
n		16	209	642	959	993	769	589	329	192	124	171
Age (years) ^a		59.7 ± 17.0	61.6 ± 16.2	65.0 ± 14.1	64.0 ± 14.6	65.8 ± 13.5	66.4 ± 13.5	66.0 ± 14.2	65.4 ± 13.7	63.0 ± 13.8	65.5 ± 13.7	63.1 ± 14.7
Sex ^b												
Men		8 (50.0)	107 (51.2)	317 (49.4)	490 (51.1)	511 (51.5)	411 (53.5)	332 (56.4)	199 (60.5)	111 (57.8)	71 (57.3)	99 (57.9)
Women		8 (50.0)	102 (48.8)	325 (50.6)	469 (48.9)	482 (48.5)	358 (46.6)	257 (43.6)	130 (39.5)	81 (42.2)	53 (42.7)	72 (42.1)
BMI (kg/m ²) ^a		26.9 ± 1.7	28.1 ± 3.3	27.9 ± 3.1	27.8 ± 3.0	27.6 ± 2.6	27.8 ± 2.9	27.7 ± 2.8	27.9 ± 2.6	28.1 ± 3.0	27.6 ± 2.7	28.4 ± 3.1
UrinaryNa/K ratio ^a		0.79 ± 0.16	1.59 ± 0.27	2.51 ± 0.28	3.47 ± 0.29	4.44 ± 0.29	5.42 ± 0.29	6.42 ± 0.29	7.43 ± 0.28	8.41 ± 0.27	9.42 ± 0.29	11.60 ± 1.74
SBP (mmHg) ^a		131.8 ± 14.9	130.5 ± 13.7	132.1 ± 15.8	133.4 ± 16.8	133.3 ± 15.6	136.2 ± 17.1	136.7 ± 16.5	136.4 ± 17.7	137.3 ± 16.6	139.5 ± 18.1	137.9 ± 15.8
DBP (mmHg) ^a		74.9 ± 11.4	76.9 ± 10.8	77.4 ± 10.1	77.8 ± 10.8	77.8 ± 10.1	78.9 ± 11.0	79.5 ± 10.8	80.0 ± 11.7	81.0 ± 11.3	80.7 ± 10.7	81.0 ± 10.2
Hypertension ^b		8 (50.0)	132 (63.2)	413 (64.3)	614 (64.0)	641 (64.6)	525 (68.3)	405 (68.8)	239 (72.6)	131 (68.2)	90 (72.6)	128 (74.9)
Habitual smoker ^b		2 (12.5)	39 (18.7)	93 (14.5)	149 (15.5)	131 (13.2)	99 (12.9)	89 (15.1)	52 (15.8)	32 (16.7)	24 (19.4)	23 (13.5)
Drinking status ^b												
Non drinker		13 (81.3)	125 (59.8)	375 (58.4)	540 (56.4)	534 (53.8)	406 (52.8)	294 (49.9)	158 (48.0)	102 (53.4)	66 (53.2)	84 (49.1)
Alcohol < 1 drink/day		1 (6.3)	49 (23.4)	153 (23.8)	237 (24.7)	258 (26.0)	218 (28.4)	168 (28.5)	90 (27.4)	37 (19.4)	31 (25.0)	43 (25.2)
Alcohol 1-2 drink/day		2 (12.5)	17 (8.1)	79 (12.3)	136 (14.2)	151 (15.2)	110 (14.3)	90 (15.3)	60 (18.2)	30 (15.7)	19 (15.3)	36 (21.1)
Alcohol 2- drink/day		0 (0.0)	18 (8.6)	35 (5.5)	45 (4.7)	49 (4.9)	35 (4.6)	37 (6.3)	21 (6.4)	22 (11.5)	8 (6.5)	8 (4.7)
User of antihypertensive Medication ^b		7 (43.8)	107 (51.2)	341 (53.1)	499 (52.0)	500 (50.4)	423 (55.0)	307 (52.1)	186 (56.5)	103 (53.7)	64 (51.6)	97 (56.7)

^a Means ± SD

^b Number, %

BMI, body mass index; DBP, diastolic blood pressure; Na/K ratio, sodium/potassium ratio; SBP, systolic blood pressure

表 1-8. Characteristics of study participants, Tome Na/K Measuring Project in 2019

Na/K ratio in 2019 (overall)		0.0-0.9	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-
n		67	724	1,980	2,734	2,850	2,236	1,451	973	581	355	615
Age (years) ^a		59.0 ± 15.6	63.2 ± 15.6	64.3 ± 14.9	65.7 ± 14.3	66.6 ± 13.5	66.6 ± 13.7	66.9 ± 13.4	66.8 ± 13.4	66.2 ± 13.4	65.6 ± 14.6	64.9 ± 13.8
Sex ^b												
Men		28 (41.8)	337 (46.6)	938 (47.4)	1,233 (45.1)	1,330 (46.7)	1,062 (47.5)	770 (53.1)	504 (51.8)	318 (54.7)	214 (60.3)	348 (56.6)
Women		39 (58.2)	387 (53.5)	1,042 (52.6)	1,501 (54.9)	1,520 (53.3)	1,174 (52.5)	681 (46.9)	469 (48.2)	263 (45.3)	141 (39.7)	267 (43.4)
BMI (kg/m ²) ^a		22.2 ± 3.6	23.7 ± 3.8	23.7 ± 3.7	23.7 ± 3.7	23.8 ± 3.8	23.8 ± 3.6	23.8 ± 3.7	24.0 ± 3.7	23.8 ± 3.7	23.8 ± 3.7	23.7 ± 3.9
UrinaryNa/K ratio ^a		0.77 ± 0.15	1.56 ± 0.27	2.51 ± 0.28	3.46 ± 0.28	4.43 ± 0.29	5.42 ± 0.28	6.42 ± 0.29	7.40 ± 0.28	8.41 ± 0.29	9.41 ± 0.29	12.37 ± 2.40
SBP (mmHg) ^a		123.7 ± 18.0	126.2 ± 17.0	125.9 ± 16.6	127.4 ± 17.0	128.7 ± 17.2	130.6 ± 17.2	130.7 ± 17.3	132.2 ± 18.1	132.3 ± 19.4	131.6 ± 15.4	132.8 ± 17.8
DBP (mmHg) ^a		72.5 ± 10.4	74.9 ± 11.0	75.0 ± 10.6	75.5 ± 10.7	76.0 ± 10.4	77.0 ± 10.5	77.3 ± 10.4	77.8 ± 11.2	77.9 ± 11.6	78.4 ± 10.7	79.0 ± 11.1
Obesity (number, %)												
Non-obese (<25.0 kg/m ²)		54 (80.6)	493 (68.1)	1,323 (66.8)	1,872 (68.5)	1,899 (66.6)	1,487 (66.5)	969 (66.8)	621 (63.8)	393 (67.6)	231 (65.1)	407 (66.2)
Obese (≥25.0 kg/m ²)		13 (19.4)	231 (31.9)	657 (33.2)	862 (31.5)	951 (33.4)	749 (33.5)	482 (33.2)	352 (36.2)	188 (32.4)	124 (34.9)	208 (33.8)
Hypertension ^b		28 (41.8)	345 (47.7)	909 (45.9)	1,337 (48.9)	1,479 (51.9)	1,185 (53.0)	812 (56.0)	576 (59.2)	325 (55.9)	206 (58.0)	395 (64.2)
Habitual smoker ^b		11 (16.4)	118 (16.3)	349 (17.6)	384 (14.1)	418 (14.7)	310 (13.9)	214 (14.8)	124 (12.7)	84 (14.5)	63 (17.8)	92 (15.0)
Drinking status ^b												
Non drinker		41 (61.2)	404 (55.9)	1,090 (55.1)	1,558 (57.0)	1,576 (55.4)	1,209 (54.1)	774 (53.3)	510 (52.5)	295 (50.8)	165 (46.5)	305 (49.6)
Alcohol < 1 drink/day		13 (19.4)	190 (26.3)	541 (27.3)	720 (26.3)	772 (27.1)	614 (27.5)	409 (28.2)	268 (27.6)	155 (26.7)	92 (25.9)	138 (22.4)
Alcohol 1-2 drink/day		11 (16.4)	98 (13.6)	242 (12.2)	312 (11.4)	362 (12.7)	295 (13.2)	189 (13.0)	140 (14.4)	89 (15.3)	71 (20.0)	105 (17.1)
Alcohol 2- drink/day		2 (3.0)	31 (4.3)	107 (5.4)	143 (5.2)	137 (4.8)	116 (5.2)	79 (5.4)	54 (5.6)	42 (7.2)	27 (7.6)	67 (10.9)
User of antihypertensive Medication ^b		21 (31.3)	274 (37.9)	723 (36.5)	1,054 (38.6)	1,149 (40.3)	916 (41.0)	692 (44.3)	437 (44.9)	241 (41.5)	156 (43.9)	300 (48.8)
Na/K ratio in 2019 (non-obese)		0.0-0.9	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-
n		54	493	1,323	1,872	1,899	1,487	969	621	393	231	407
Age (years) ^a		58.4 ± 16.5	63.2 ± 16.2	64.1 ± 15.0	65.7 ± 14.6	66.6 ± 13.6	67.0 ± 13.6	67.2 ± 13.4	67.2 ± 13.3	65.8 ± 14.1	65.3 ± 15.2	65.6 ± 13.2
Sex ^b												
Men		21 (38.9)	221 (44.8)	588 (44.4)	800 (42.7)	838 (44.1)	677 (45.5)	491 (50.7)	318 (51.2)	201 (51.2)	129 (55.8)	234 (57.5)
Women		33 (61.1)	272 (55.2)	735 (55.6)	1,072 (57.3)	1,061 (55.9)	810 (54.5)	478 (49.3)	303 (48.8)	192 (48.9)	102 (44.2)	173 (42.5)
BMI (kg/m ²) ^a		21.0 ± 2.7	21.6 ± 2.2	21.7 ± 2.1	21.7 ± 2.1	21.8 ± 2.1	21.9 ± 2.1	21.8 ± 2.1	21.8 ± 2.1	21.8 ± 2.1	21.8 ± 2.1	21.6 ± 2.2
UrinaryNa/K ratio ^a		0.77 ± 0.16	1.57 ± 0.26	2.52 ± 0.28	3.46 ± 0.28	4.43 ± 0.29	5.42 ± 0.28	6.42 ± 0.28	7.40 ± 0.28	8.40 ± 0.28	9.39 ± 0.29	12.24 ± 2.30
SBP (mmHg) ^a		121.9 ± 17.9	123.9 ± 16.8	123.8 ± 16.7	125.5 ± 17.5	126.9 ± 17.4	129.1 ± 17.5	129.0 ± 18.0	131.1 ± 18.8	130.1 ± 18.9	130.1 ± 16.4	132.1 ± 18.6
DBP (mmHg) ^a		70.6 ± 10.0	73.3 ± 10.7	73.4 ± 10.5	74.1 ± 10.6	74.9 ± 10.4	76.0 ± 10.5	76.0 ± 10.5	76.6 ± 11.4	76.5 ± 11.0	77.5 ± 10.6	78.5 ± 11.5
Hypertension ^b		19 (35.2)	197 (40.0)	527 (39.8)	796 (42.5)	865 (45.6)	688 (46.3)	489 (50.5)	331 (53.3)	179 (45.6)	114 (49.4)	240 (59.0)
Habitual smoker ^b		10 (18.5)	77 (15.6)	231 (17.5)	264 (14.1)	283 (14.9)	202 (13.6)	156 (16.1)	85 (13.7)	59 (15.0)	42 (18.2)	67 (16.5)
Drinking status ^b												
Non drinker		33 (61.1)	277 (56.2)	725 (54.8)	1,057 (56.5)	1,063 (56.0)	807 (54.3)	533 (55.0)	333 (53.7)	209 (53.2)	112 (48.5)	183 (45.0)
Alcohol < 1 drink/day		11 (20.4)	133 (27.0)	372 (28.1)	488 (26.1)	531 (28.0)	420 (28.3)	271 (28.0)	169 (27.3)	103 (26.2)	64 (27.7)	96 (23.6)
Alcohol 1-2 drink/day		9 (16.7)	65 (13.2)	159 (12.0)	220 (11.8)	217 (11.4)	187 (12.6)	119 (12.3)	85 (13.7)	56 (14.3)	40 (17.3)	74 (18.2)
Alcohol 2- drink/day		1 (1.9)	18 (3.7)	67 (5.1)	106 (5.7)	86 (4.5)	71 (4.8)	46 (4.8)	33 (5.3)	25 (6.4)	15 (6.5)	54 (13.3)
User of antihypertensive Medication ^b		16 (29.6)	157 (31.9)	401 (30.3)	611 (32.6)	660 (34.8)	513 (34.5)	375 (38.7)	240 (38.7)	125 (31.8)	81 (35.1)	179 (44.0)
Na/K ratio in 2019 (obese)		0.0-0.9	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	10.0-
n		13	231	657	862	951	749	482	352	188	124	208
Age (years) ^a		61.1 ± 11.3	63.2 ± 14.4	64.6 ± 14.7	65.7 ± 13.8	66.4 ± 13.5	65.9 ± 13.9	66.4 ± 13.3	66.0 ± 13.6	67.1 ± 11.8	66.3 ± 13.5	63.5 ± 14.8
Sex ^b												
Men		7 (53.9)	116 (50.2)	350 (53.3)	433 (50.2)	492 (51.7)	385 (51.4)	279 (57.9)	186 (52.8)	117 (62.2)	85 (68.6)	114 (54.8)
Women		6 (46.2)	115 (49.8)	307 (46.7)	429 (49.8)	459 (48.3)	364 (48.6)	203 (42.1)	166 (47.2)	71 (37.8)	39 (31.5)	94 (45.2)
BMI (kg/m ²) ^a		27.2 ± 2.2	28.1 ± 2.8	27.7 ± 2.7	27.9 ± 2.9	27.8 ± 3.1	27.7 ± 2.8	27.8 ± 2.7	27.8 ± 2.7	27.9 ± 2.7	27.7 ± 2.7	27.9 ± 2.9
UrinaryNa/K ratio ^a		0.75 ± 0.14	1.54 ± 0.27	2.49 ± 0.28	3.46 ± 0.28	4.43 ± 0.28	5.43 ± 0.29	6.42 ± 0.29	7.40 ± 0.29	8.44 ± 0.29	9.44 ± 0.27	12.62 ± 2.57
SBP (mmHg) ^a		130.8 ± 17.3	131.0 ± 16.2	130.3 ± 15.7	131.6 ± 15.1	132.5 ± 16.2	133.5 ± 16.3	134.1 ± 15.4	134.1 ± 16.6	137.0 ± 19.7	134.3 ± 12.9	134.2 ± 16.0
DBP (mmHg) ^a		80.5 ± 8.2	78.2 ± 10.8	78.1 ± 10.2	78.5 ± 10.1	78.3 ± 10.1	79.2 ± 10.2	79.9 ± 9.6	80.1 ± 10.5	81.0 ± 12.2	80.0 ± 10.8	79.9 ± 10.2
Hypertension ^b		9 (69.2)	148 (64.1)	382 (58.1)	541 (62.8)	614 (64.6)	497 (66.4)	323 (67.0)	245 (69.6)	146 (77.7)	92 (74.2)	155 (74.5)
Habitual smoker ^b		1 (7.7)	41 (17.8)	118 (18.0)	120 (13.9)	135 (14.2)	108 (14.4)	58 (12.0)	39 (11.1)	25 (13.3)	21 (16.9)	25 (12.0)
Drinking status ^b												
Non drinker		8 (61.5)	127 (55.2)	365 (55.6)	501 (58.1)	513 (54.0)	402 (53.7)	241 (50.0)	177 (50.3)	86 (45.7)	53 (42.7)	122 (58.7)
Alcohol < 1 drink/day		2 (15.4)	57 (24.8)	169 (25.7)	232 (26.9)	241 (25.4)	194 (25.9)	138 (28.6)	99 (28.1)	52 (27.7)	28 (22.6)	42 (20.2)
Alcohol 1-2 drink/day		2 (15.4)	33 (14.4)	83 (12.6)	92 (10.7)	145 (15.3)	108 (14.4)	70 (14.5)	55 (15.6)	33 (17.6)	31 (25.0)	31 (14.9)
Alcohol 2- drink/day		1 (7.7)	13 (5.7)	40 (6.1)	37 (4.3)	51 (5.4)	45 (6.0)	33 (6.9)	21 (6.0)	17 (9.0)	12 (9.7)	13 (6.3)
User of antihypertensive Medication ^b		5 (38.5)	117 (50.7)	322 (49.0)	443 (51.4)	489 (51.4)	403 (53.8)	267 (55.4)	197 (56.0)	116 (61.7)	75 (60.5)	121 (58.2)

^a Means ± SD^b Number, %

BMI, body mass index; DBP, diastolic blood pressure; Na/K ratio, sodium/potassium ratio; SBP, systolic blood pressure

表 1-9. Relationship between the urinary Na/K ratio and hypertension, Tome Na/K Measuring Project, 2017-2019

2017																	
Overall (n=15,338)			Odds ratio, 95% CI			Non-obese (n=10,281)			Odds ratio, 95% CI			Obese (n=5,059)			Odds ratio, 95% CI		
Age	per 1 year		1.08	1.07	1.08	Age	per 1 year		1.08	1.08	1.09	Age	per 1 year		1.06	1.06	1.07
Women	vs. men		1.04	0.96	1.13	Women	vs. men		1.03	0.94	1.14	Women	vs. men		0.93	0.81	1.07
Urinary Na/K ratio	< 3.0			1.00 (ref)		Urinary Na/K ratio	< 3.0			1.00 (ref)		Urinary Na/K ratio	< 3.0			1.00 (ref)	
	3.0-3.9		1.06	0.94	1.21		3.0-3.9		1.08	0.93	1.26		3.0-3.9		1.05	0.84	1.31
	4.0-4.9		1.09	0.97	1.23		4.0-4.9		1.16	1.00	1.34		4.0-4.9		0.96	0.77	1.19
	5.0-5.9		1.19	1.04	1.35		5.0-5.9		1.29	1.11	1.50		5.0-5.9		0.99	0.79	1.24
	6.0-6.9		1.25	1.09	1.44		6.0-6.9		1.26	1.07	1.49		6.0-6.9		1.25	0.98	1.61
	7.0-7.9		1.51	1.28	1.77		7.0-7.9		1.50	1.23	1.81		7.0-7.9		1.62	1.21	2.16
	8.0-8.9		1.39	1.15	1.68		8.0-8.9		1.36	1.08	1.72		8.0-8.9		1.42	1.03	1.97
	9.0-9.9		2.14	1.67	2.75		9.0-9.9		1.91	1.43	2.56		9.0-9.9		3.09	1.89	5.08
	10+		2.17	1.83	2.58		10+		2.31	1.88	2.84		10+		1.82	1.35	2.45
	P for trend			< 0.01			P for trend			< 0.01			P for trend			< 0.01	
Drinking status	Never-drinker			1.00		Drinking status	Never-drinker			1.00		Drinking status	Never-drinker			1.00	
	Alkohol < 1 drink/day*		1.12	1.03	1.23		Alkohol < 1 drink/day*		1.18	1.06	1.31		Alkohol < 1 drink/day*		0.99	0.84	1.15
	Alkohol 1-2 drink/day		1.96	1.73	2.21		Alkohol 1-2 drink/day		2.15	1.85	2.50		Alkohol 1-2 drink/day		1.51	1.23	1.87
	Alkohol ≥2 drink/day		2.69	2.25	3.21		Alkohol ≥2 drink/day		2.92	2.36	3.61		Alkohol ≥2 drink/day		1.97	1.44	2.68
BMI	per 1 kg/m ²		1.18	1.17	1.19	BMI	per 1 kg/m ²					BMI	per 1 kg/m ²				
PAF			17.6%			PAF			19.7%			PAF			13.3%		
2018																	
Overall (n=15,058)			Odds ratio, 95% CI			Non-obese (n=10,068)			Odds ratio, 95% CI			Obese (n=4,990)			Odds ratio, 95% CI		
Age	per 1 year		1.08	1.08	1.08	Age	per 1 year		1.08	1.07	1.08	Age	per 1 year		1.07	1.07	1.08
Women	vs. men		1.06	0.98	1.15	Women	vs. men		1.04	0.94	1.15	Women	vs. men		0.98	0.84	1.13
Urinary Na/K ratio	< 3.0			1.00 (ref)		Urinary Na/K ratio	< 3.0			1.00 (ref)		Urinary Na/K ratio	< 3.0			1.00 (ref)	
	3.0-3.9		0.96	0.85	1.08		3.0-3.9		0.92	0.80	1.07		3.0-3.9		1.02	0.83	1.27
	4.0-4.9		1.00	0.89	1.12		4.0-4.9		1.02	0.88	1.17		4.0-4.9		0.92	0.74	1.13
	5.0-5.9		1.18	1.04	1.34		5.0-5.9		1.21	1.04	1.40		5.0-5.9		1.08	0.86	1.35
	6.0-6.9		1.14	0.99	1.32		6.0-6.9		1.16	0.97	1.37		6.0-6.9		1.12	0.87	1.43
	7.0-7.9		1.36	1.14	1.61		7.0-7.9		1.28	1.05	1.57		7.0-7.9		1.44	1.06	1.95
	8.0-8.9		1.35	1.09	1.67		8.0-8.9		1.40	1.09	1.81		8.0-8.9		1.31	0.91	1.90
	9.0-9.9		1.73	1.33	2.26		9.0-9.9		1.86	1.35	2.56		9.0-9.9		1.44	0.91	2.28
	10+		1.95	1.54	2.47		10+		1.90	1.43	2.51		10+		2.02	1.33	3.07
	P for trend			< 0.01			P for trend			< 0.01			P for trend			< 0.01	
Drinking status	Never-drinker			1.00		Drinking status	Never-drinker			1.00		Drinking status	Never-drinker			1.00	
	Alkohol < 1 drink/day*		1.08	0.99	1.18		Alkohol < 1 drink/day*		1.09	0.98	1.21		Alkohol < 1 drink/day*		1.03	0.88	1.20
	Alkohol 1-2 drink/day		1.82	1.61	2.05		Alkohol 1-2 drink/day		1.99	1.72	2.31		Alkohol 1-2 drink/day		1.34	1.09	1.66
	Alkohol ≥2 drink/day		3.05	2.55	3.64		Alkohol ≥2 drink/day		3.21	2.60	3.96		Alkohol ≥2 drink/day		2.42	1.75	3.35
BMI	per 1 kg/m ²		1.19	1.17	1.20	BMI	per 1 kg/m ²					BMI	per 1 kg/m ²				
PAF			8.9%			PAF			8.9%			PAF			6.9%		
2019																	
Overall (n=14,557)			Odds ratio, 95% CI			Non-obese (n=9,743)			Odds ratio, 95% CI			Obese (n=4,815)			Odds ratio, 95% CI		
Age	per 1 year		1.08	1.07	1.08	Age	per 1 year		1.08	1.07	1.08	Age	per 1 year		1.07	1.06	1.07
Women	vs. men		1.03	0.95	1.12	Women	vs. men		1.02	0.92	1.13	Women	vs. men		0.92	0.79	1.06
Urinary Na/K ratio	< 3.0			1.00 (ref)		Urinary Na/K ratio	< 3.0			1.00 (ref)		Urinary Na/K ratio	< 3.0			1.00 (ref)	
	3.0-3.9		1.01	0.90	1.14		3.0-3.9		1.01	0.87	1.16		3.0-3.9		1.07	0.87	1.32
	4.0-4.9		1.09	0.97	1.23		4.0-4.9		1.12	0.97	1.29		4.0-4.9		1.08	0.88	1.32
	5.0-5.9		1.13	1.00	1.28		5.0-5.9		1.11	0.96	1.29		5.0-5.9		1.23	0.99	1.53
	6.0-6.9		1.29	1.12	1.49		6.0-6.9		1.34	1.13	1.59		6.0-6.9		1.21	0.94	1.56
	7.0-7.9		1.48	1.26	1.75		7.0-7.9		1.50	1.23	1.84		7.0-7.9		1.43	1.07	1.90
	8.0-8.9		1.33	1.09	1.63		8.0-8.9		1.14	0.89	1.44		8.0-8.9		2.07	1.40	3.07
	9.0-9.9		1.47	1.14	1.89		9.0-9.9		1.36	1.01	1.85		9.0-9.9		1.73	1.09	2.74
	10+		2.20	1.79	2.70		10+		2.02	1.59	2.58		10+		2.34	1.60	3.42
	P for trend			< 0.01			P for trend			< 0.01			P for trend			< 0.01	
Drinking status	Never-drinker			1.00		Drinking status	Never-drinker			1.00		Drinking status	Never-drinker			1.00	
	Alkohol < 1 drink/day*		1.11	1.02	1.22		Alkohol < 1 drink/day*		1.11	1.00	1.24		Alkohol < 1 drink/day*		1.11	0.95	1.31
	Alkohol 1-2 drink/day		2.01	1.78	2.28		Alkohol 1-2 drink/day		2.18	1.87	2.53		Alkohol 1-2 drink/day		1.57	1.26	1.94
	Alkohol ≥2 drink/day		2.41	2.03	2.88		Alkohol ≥2 drink/day		2.60	2.10	3.20		Alkohol ≥2 drink/day		1.83	1.35	2.49
BMI	per 1 kg/m ²		1.18	1.17	1.19	BMI	per 1 kg/m ²					BMI	per 1 kg/m ²				
PAF			13.3%			PAF			12.9%			PAF			16.0%		

Abbreviations: BMI, body mass index; Na/K, sodium/potassium ratio; 95% CI, 95% confidence interval

*One drink in Japan corresponds to 23 g of ethanol.

表 1-10. Relationship between the urinary Na/K ratio and SBP using multiple regression analyses adjusted for age, sex, BMI, and alcohol intake, Tome Na/K Measuring Project, 2017-2019

2017						2018						2019					
Overall (n=15,338)			Non-obese (n=10,279)			Overall (n=15,058)			Non-obese (n=10,068)			Overall (n=14,557)			Non-obese (n=9,742)		
	β	P value		β	P value		β	P value		β	P value		β	P value		β	P value
Age (per 1 year)	0.37	< 0.01	Age (per 1 year)	0.41	< 0.01	Age (per 1 year)	0.41	< 0.01	Age (per 1 year)	0.43	< 0.01	Age (per 1 year)	0.39	< 0.01	Age (per 1 year)	0.43	< 0.01
Women (vs. men)	-0.14	0.65	Women (vs. men)	0.01	0.98	Women (vs. men)	1.43	< 0.01	Women (vs. men)	1.43	< 0.01	Women (vs. men)	1.55	< 0.01	Women (vs. men)	1.83	< 0.01
Alcohol intake (per 1 g/day)	2.59	< 0.01	Alcohol intake (per 1 g/day)	3.12	< 0.01	Alcohol intake (per 1 g/day)	3.08	< 0.01	Alcohol intake (per 1 g/day)	3.08	< 0.01	Alcohol intake (per 1 g/day)	2.49	< 0.01	Alcohol intake (per 1 g/day)	2.98	< 0.01
BMI (per 1 kg/m ²)	1.14	< 0.01	BMI (per 1 kg/m ²)	1.23	< 0.01	BMI (per 1 kg/m ²)	1.12	< 0.01	BMI (per 1 kg/m ²)	1.12	< 0.01	BMI (per 1 kg/m ²)	0.96	< 0.01	BMI (per 1 kg/m ²)	1.10	< 0.01
Urinary Na/K ratio (per 1 unit)	0.57	< 0.01	Urinary Na/K ratio (per 1 unit)	0.58	< 0.01	Urinary Na/K ratio (per 1 unit)	0.84	< 0.01	Urinary Na/K ratio (per 1 unit)	0.84	< 0.01	Urinary Na/K ratio (per 1 unit)	0.69	< 0.01	Urinary Na/K ratio (per 1 unit)	0.79	< 0.01

Abbreviations: BMI, body mass index; Na/K ratio, sodium/potassium ratio; SBP, systolic blood pressure

表 2-1 2017 年-2019 年の登米市特定健診で測定した尿ナトカリ比值変化と収縮期血圧値の変化との関連
(肥満・非肥満で層別化)

2017-2018								
Overall (n=11,258)			Non-obese in 2017 (n=7,567)			Obese in 2017 (n=3,691)		
	β	P value		β	P value		β	P value
Age (per 1 year) in 2017	0.02	0.07	Age (per 1 year) in 2017	0.02	0.07	Age (per 1 year) in 2017	0.01	0.65
Women (vs. men)	1.35	< 0.01	Women (vs. men)	1.11	< 0.01	Women (vs. men)	1.69	< 0.01
Difference between alcohol intake in 2017 and in 2018 (per 1 g/day)	1.23	< 0.01	Difference between alcohol intake in 2017 and in 2018 (per 1 g/day)	1.11	0.02	Difference between alcohol intake in 2017 and in 2018 (per 1 g/day)	1.46	0.03
Difference between BMI in 2017 and in 2018 (per 1 kg/m ²)	2.32	< 0.01	Difference between BMI in 2017 and in 2018 (per 1 kg/m ²)	2.62	< 0.01	Difference between BMI in 2017 and in 2018 (per 1 kg/m ²)	1.82	< 0.01
Difference between urinary Na/K ratio in 2017 and in 2018 (per 1 unit)	0.46	< 0.01	Difference between urinary Na/K ratio in 2017 and in 2018 (per 1 unit)	0.44	< 0.01	Difference between urinary Na/K ratio in 2017 and in 2018 (per 1 unit)	0.50	< 0.01
2018-2019								
Overall (n=11,252)			Non-obese in 2018 (n=7,563)			Obese in 2018 (n=3,689)		
	β	P value		β	P value		β	P value
Age (per 1 year) in 2018	0.01	0.48	Age (per 1 year) in 2018	0.02	0.13	Age (per 1 year) in 2018	-0.01	0.40
Women (vs. men)	0.44	0.08	Women (vs. men)	0.39	0.21	Women (vs. men)	0.46	0.3
Difference between alcohol intake in 2018 and in 2019 (per 1 g/day)	0.91	0.02	Difference between alcohol intake in 2018 and in 2019 (per 1 g/day)	1.12	0.02	Difference between alcohol intake in 2018 and in 2019 (per 1 g/day)	0.55	0.40
Difference between BMI in 2018 and in 2019 (per 1 kg/m ²)	2.36	< 0.01	Difference between BMI in 2018 and in 2019 (per 1 kg/m ²)	2.75	< 0.01	Difference between BMI in 2018 and in 2019 (per 1 kg/m ²)	1.87	< 0.01
Difference between urinary Na/K ratio in 2018 and in 2019 (per 1 unit)	0.52	< 0.01	Difference between urinary Na/K ratio in 2018 and in 2019 (per 1 unit)	0.50	< 0.01	Difference between urinary Na/K ratio in 2018 and in 2019 (per 1 unit)	0.56	< 0.01
2017-2019								
Overall (n=11,252)			Non-obese in 2017 (n=7,563)			Obese in 2017 (n=3,689)		
	β	P value		β	P value		β	P value
Age (per 1 year) in 2017	0.02	0.05	Age (per 1 year) in 2017	0.03	0.02	Age (per 1 year) in 2017	0.002	0.94
Women (vs. men)	1.84	< 0.01	Women (vs. men)	1.63	< 0.01	Women (vs. men)	2.06	< 0.01
Difference between alcohol intake in 2017 and in 2019 (per 1 g/day)	0.78	0.06	Difference between alcohol intake in 2017 and in 2019 (per 1 g/day)	0.59	0.24	Difference between alcohol intake in 2017 and in 2019 (per 1 g/day)	1.18	0.10
Difference between BMI in 2017 and in 2019 (per 1 kg/m ²)	1.82	< 0.01	Difference between BMI in 2017 and in 2019 (per 1 kg/m ²)	2.07	< 0.01	Difference between BMI in 2017 and in 2019 (per 1 kg/m ²)	1.37	< 0.01
Difference between urinary Na/K ratio in 2017 and in 2019 (per 1 unit)	0.37	< 0.01	Difference between urinary Na/K ratio in 2017 and in 2019 (per 1 unit)	0.35	< 0.01	Difference between urinary Na/K ratio in 2017 and in 2019 (per 1 unit)	0.42	< 0.01

Abbreviations: BMI, body mass index; Na/K ratio, sodium/potassium ratio; SBP, systolic blood pressure

表 2-2 2017 年-2019 年の登米市特定健診で測定した尿ナトカリ比值変化と収縮期血圧値の変化との関連
(降圧薬未服用者、肥満・非肥満で層別化)

2017-2018								
Overall (n=6,447)			Non-obese in 2017 (n=4,820)			Obese in 2017 (n=1,627)		
	β	P value		β	P value		β	P value
Age (per 1 year) in 2017	0.03	< 0.01	Age (per 1 year) in 2017	0.04	< 0.01	Age (per 1 year) in 2017	0.01	0.60
Women (vs. men)	0.71	0.02	Women (vs. men)	0.83	0.02	Women (vs. men)	0.34	0.59
Difference between alcohol intake in 2017 and in 2018 (per 1 g/day)	0.54	0.26	Difference between alcohol intake in 2017 and in 2018 (per 1 g/day)	0.70	0.20	Difference between alcohol intake in 2017 and in 2018 (per 1 g/day)	0.14	0.88
Difference between BMI in 2017 and in 2018 (per 1 kg/m ²)	2.43	< 0.01	Difference between BMI in 2017 and in 2018 (per 1 kg/m ²)	2.73	< 0.01	Difference between BMI in 2017 and in 2018 (per 1 kg/m ²)	1.92	< 0.01
Difference between urinary Na/K ratio in 2017 and in 2018 (per 1 unit)	0.51	< 0.01	Difference between urinary Na/K ratio in 2017 and in 2018 (per 1 unit)	0.48	< 0.01	Difference between urinary Na/K ratio in 2017 and in 2018 (per 1 unit)	0.59	< 0.01
2018-2019								
Overall (n=6,263)			Non-obese in 2018 (n=4,691)			Obese in 2018 (n=1,572)		
	β	P value		β	P value		β	P value
Age (per 1 year) in 2018	0.03	< 0.01	Age (per 1 year) in 2018	0.05	< 0.01	Age (per 1 year) in 2018	0.002	0.94
Women (vs. men)	0.54	0.08	Women (vs. men)	0.43	0.24	Women (vs. men)	0.90	0.15
Difference between alcohol intake in 2018 and in 2019 (per 1 g/day)	1.65	< 0.01	Difference between alcohol intake in 2018 and in 2019 (per 1 g/day)	1.79	< 0.01	Difference between alcohol intake in 2018 and in 2019 (per 1 g/day)	1.35	0.14
Difference between BMI in 2018 and in 2019 (per 1 kg/m ²)	2.39	< 0.01	Difference between BMI in 2018 and in 2019 (per 1 kg/m ²)	2.84	< 0.01	Difference between BMI in 2018 and in 2019 (per 1 kg/m ²)	1.81	< 0.01
Difference between urinary Na/K ratio in 2018 and in 2019 (per 1 unit)	0.56	< 0.01	Difference between urinary Na/K ratio in 2018 and in 2019 (per 1 unit)	0.55	< 0.01	Difference between urinary Na/K ratio in 2018 and in 2019 (per 1 unit)	0.59	< 0.01
2017-2019								
Overall (n=6,202)			Non-obese in 2017 (n=4,660)			Obese in 2017 (n=1,542)		
	β	P value		β	P value		β	P value
Age (per 1 year) in 2017	0.07	< 0.01	Age (per 1 year) in 2017	0.08	< 0.01	Age (per 1 year) in 2017	0.02	0.41
Women (vs. men)	1.25	< 0.01	Women (vs. men)	1.34	< 0.01	Women (vs. men)	0.98	0.15
Difference between alcohol intake in 2017 and in 2019 (per 1 g/day)	1.25	0.01	Difference between alcohol intake in 2017 and in 2019 (per 1 g/day)	0.93	0.13	Difference between alcohol intake in 2017 and in 2019 (per 1 g/day)	2.11	0.03
Difference between BMI in 2017 and in 2019 (per 1 kg/m ²)	2.17	< 0.01	Difference between BMI in 2017 and in 2019 (per 1 kg/m ²)	2.32	< 0.01	Difference between BMI in 2017 and in 2019 (per 1 kg/m ²)	1.93	< 0.01
Difference between urinary Na/K ratio in 2017 and in 2019 (per 1 unit)	0.43	< 0.01	Difference between urinary Na/K ratio in 2017 and in 2019 (per 1 unit)	0.44	< 0.01	Difference between urinary Na/K ratio in 2017 and in 2019 (per 1 unit)	0.42	< 0.01

Abbreviations: BMI, body mass index; Na/K ratio, sodium/potassium ratio; SBP, systolic blood pressure

表 2-3 2021 年-2023 年の大崎市特定健診で測定した尿ナトカリ比值変化と収縮期血圧値の変化との関連
(肥満・非肥満で層別化)

2021-2022								
Overall (n=5,878)			Non-obese in 2021 (n=4,021)			Obese in 2021 (n=1,857)		
	β	P value		β	P value		β	P value
Age (per 1 year) in 2021	-0.02	0.21	Age (per 1 year) in 2021	-0.02	0.40	Age (per 1 year) in 2021	-0.03	0.32
Women (vs. men)	0.84	0.01	Women (vs. men)	0.68	0.08	Women (vs. men)	1.13	0.08
Difference between alcohol intake in 2021 and in 2022 (per 1 g/day)	1.14	0.01	Difference between alcohol intake in 2021 and in 2022 (per 1 g/day)	1.03	0.05	Difference between alcohol intake in 2021 and in 2022 (per 1 g/day)	1.37	0.1
Difference between BMI in 2021 and in 2022 (per 1 kg/m ²)	2.07	< 0.01	Difference between BMI in 2021 and in 2022 (per 1 kg/m ²)	2.36	< 0.01	Difference between BMI in 2021 and in 2022 (per 1 kg/m ²)	1.69	< 0.01
Difference between urinary Na/K ratio in 2021 and in 2022 (per 1 unit)	0.44	< 0.01	Difference between urinary Na/K ratio in 2021 and in 2022 (per 1 unit)	0.41	< 0.01	Difference between urinary Na/K ratio in 2021 and in 2022 (per 1 unit)	0.50	< 0.01
2022-2023								
Overall (n=5,407)			Non-obese in 2022 (n=3,689)			Obese in 2022 (n=1,718)		
	β	P value		β	P value		β	P value
Age (per 1 year) in 2022	0.02	0.33	Age (per 1 year) in 2022	-0.001	0.95	Age (per 1 year) in 2022	0.06	0.07
Women (vs. men)	0.19	0.58	Women (vs. men)	0.24	0.56	Women (vs. men)	0.03	0.97
Difference between alcohol intake in 2022 and in 2023 (per 1 g/day)	0.15	0.74	Difference between alcohol intake in 2022 and in 2023 (per 1 g/day)	-0.05	0.93	Difference between alcohol intake in 2022 and in 2023 (per 1 g/day)	0.52	0.52
Difference between BMI in 2022 and in 2023 (per 1 kg/m ²)	2.10	< 0.01	Difference between BMI in 2022 and in 2023 (per 1 kg/m ²)	2.04	< 0.01	Difference between BMI in 2022 and in 2023 (per 1 kg/m ²)	2.13	< 0.01
Difference between urinary Na/K ratio in 2022 and in 2023 (per 1 unit)	0.56	< 0.01	Difference between urinary Na/K ratio in 2022 and in 2023 (per 1 unit)	0.57	< 0.01	Difference between urinary Na/K ratio in 2022 and in 2023 (per 1 unit)	0.55	< 0.01
2021-2023								
Overall (n=5,407)			Non-obese in 2021 (n=3,688)			Obese in 2021 (n=1,719)		
	β	P value		β	P value		β	P value
Age (per 1 year) in 2021	-0.001	0.94	Age (per 1 year) in 2021	-0.002	0.31	Age (per 1 year) in 2021	0.04	0.19
Women (vs. men)	1.12	< 0.01	Women (vs. men)	1.23	< 0.01	Women (vs. men)	0.67	0.33
Difference between alcohol intake in 2021 and in 2023 (per 1 g/day)	1.29	< 0.01	Difference between alcohol intake in 2021 and in 2023 (per 1 g/day)	1.48	< 0.01	Difference between alcohol intake in 2021 and in 2023 (per 1 g/day)	0.96	0.22
Difference between BMI in 2021 and in 2023 (per 1 kg/m ²)	2.06	< 0.01	Difference between BMI in 2021 and in 2023 (per 1 kg/m ²)	1.83	< 0.01	Difference between BMI in 2021 and in 2023 (per 1 kg/m ²)	2.28	< 0.01
Difference between urinary Na/K ratio in 2021 and in 2023 (per 1 unit)	0.42	< 0.01	Difference between urinary Na/K ratio in 2021 and in 2023 (per 1 unit)	0.39	< 0.01	Difference between urinary Na/K ratio in 2021 and in 2023 (per 1 unit)	0.48	< 0.01

Abbreviations: BMI, body mass index; Na/K ratio, sodium/potassium ratio; SBP, systolic blood pressure

表 2-4 2021 年-2023 年の大崎市特定健診で測定した尿ナトカリ比值変化と収縮期血圧値の変化との関連
(降圧薬未服用者, 肥満・非肥満で層別化)

2021-2022								
Overall (n=3,601)			Non-obese in 2021 (n=2,744)			Obese in 2021 (n=857)		
	β	P value		β	P value		β	P value
Age (per 1 year) in 2021	0.000005	0.99	Age (per 1 year) in 2021	-0.004	0.83	Age (per 1 year) in 2021	0.01	0.73
Women (vs. men)	0.38	0.32	Women (vs. men)	0.04	0.93	Women (vs. men)	1.78	0.03
Difference between alcohol intake in 2021 and in 2022 (per 1 g/day)	-0.20	0.73	Difference between alcohol intake in 2021 and in 2022 (per 1 g/day)	-0.29	0.66	Difference between alcohol intake in 2021 and in 2022 (per 1 g/day)	0.15	0.91
Difference between BMI in 2021 and in 2022 (per 1 kg/m ²)	2.23	< 0.01	Difference between BMI in 2021 and in 2022 (per 1 kg/m ²)	2.27	< 0.01	Difference between BMI in 2021 and in 2022 (per 1 kg/m ²)	2.20	< 0.01
Difference between urinary Na/K ratio in 2021 and in 2022 (per 1 unit)	0.52	< 0.01	Difference between urinary Na/K ratio in 2021 and in 2022 (per 1 unit)	0.46	< 0.01	Difference between urinary Na/K ratio in 2021 and in 2022 (per 1 unit)	0.68	< 0.01
2022-2023								
Overall (n=3,263)			Non-obese in 2022 (n=2,487)			Obese in 2022 (n=776)		
	β	P value		β	P value		β	P value
Age (per 1 year) in 2022	0.05	0.01	Age (per 1 year) in 2022	0.04	0.02	Age (per 1 year) in 2022	0.06	0.07
Women (vs. men)	0.64	0.11	Women (vs. men)	0.82	0.07	Women (vs. men)	0.03	0.97
Difference between alcohol intake in 2022 and in 2023 (per 1 g/day)	-0.01	0.99	Difference between alcohol intake in 2022 and in 2023 (per 1 g/day)	-0.49	0.46	Difference between alcohol intake in 2022 and in 2023 (per 1 g/day)	1.56	0.21
Difference between BMI in 2022 and in 2023 (per 1 kg/m ²)	2.31	< 0.01	Difference between BMI in 2022 and in 2023 (per 1 kg/m ²)	2.32	< 0.01	Difference between BMI in 2022 and in 2023 (per 1 kg/m ²)	2.28	< 0.01
Difference between urinary Na/K ratio in 2022 and in 2023 (per 1 unit)	0.51	< 0.01	Difference between urinary Na/K ratio in 2022 and in 2023 (per 1 unit)	0.42	< 0.01	Difference between urinary Na/K ratio in 2022 and in 2023 (per 1 unit)	0.84	< 0.01
2021-2023								
Overall (n=3,237)			Non-obese in 2021 (n=2,480)			Obese in 2021 (n=757)		
	β	P value		β	P value		β	P value
Age (per 1 year) in 2021	0.04	0.01	Age (per 1 year) in 2021	0.03	0.11	Age (per 1 year) in 2021	0.09	0.02
Women (vs. men)	1.10	< 0.01	Women (vs. men)	1.09	0.02	Women (vs. men)	1.34	0.13
Difference between alcohol intake in 2021 and in 2023 (per 1 g/day)	1.52	< 0.01	Difference between alcohol intake in 2021 and in 2023 (per 1 g/day)	1.63	0.02	Difference between alcohol intake in 2021 and in 2023 (per 1 g/day)	1.29	0.25
Difference between BMI in 2021 and in 2023 (per 1 kg/m ²)	2.25	< 0.01	Difference between BMI in 2021 and in 2023 (per 1 kg/m ²)	2.14	< 0.01	Difference between BMI in 2021 and in 2023 (per 1 kg/m ²)	2.45	< 0.01
Difference between urinary Na/K ratio in 2021 and in 2023 (per 1 unit)	0.40	< 0.01	Difference between urinary Na/K ratio in 2021 and in 2023 (per 1 unit)	0.36	< 0.01	Difference between urinary Na/K ratio in 2021 and in 2023 (per 1 unit)	0.53	< 0.01

Abbreviations: BMI, body mass index; Na/K ratio, sodium/potassium ratio; SBP, systolic blood pressure

図 1. 登米市 2017-2019年にかけての特定健診尿ナトカリ比参加者の概要

